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MPUTING

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ZX Computing is constantly on the look-out for well-written articles and programs. If you think that your efforts meet our standards, please feel free to submit your work to us for consideration.

All submitted material should be typed if possible; handwritten work will be considered, but please use your neatest handwriting. Any programs submitted should be listed, a cassette of your program alone will not be considered. All programs must come complete with a full explanation of the operation and, where relevant, the structure; Spectrum programs should be accompanied with a cassette of the program (which will be returned) as well as the listing.

All submissions will be acknowledged and any published work will be paid for at competitive rates. All work for consideration should be sent to the Editor at our Charing Cross Road address.

Welcome



Nice to be here once again with another package of information, news, reviews and best of all, programs, all for your Sinclair computer.

Over the past few issues, I have been introducing a number of features such as Reader's reviews, Club corner, Problem page and the newest of them all, The 1K corral. Well, what do you think of them? If you have any comments, or you'd like to see something new within these pages, write in and tell me — there's nowt so refreshing as feedback!

Going down

Everytime I shut up shop on my news pages, something big always happens — the problems of being a bi-monthly! So, as soon as I finished the news last issue, what do I hear but all the prices on the Spectrums are to be reduced. If you didn't catch the news in the computer press, the 16K and 48K Spectrums have reduced in price to 99.95 and £129.95 respectively. And not only that but the ZX Printer has come down from £59.95 to £39.95. So, if you were waiting in the wings wondering whether to make a leap to the ZX Spectrum, now seems like a pretty good time!

And talking of things Sinclair, did you all see the article in the *Sunday Times Magazine* concerning 'A life in the day of Clive Sinclair'. How about this for a morning routine 'I usually get up at about 6.30, make a cup of tea, read the papers, then go for an hour's run of seven or eight miles'. And that's all before most of the country has even managed to get themselves out of bed!

Clive also talked to *Sunday Times Magazine's* Jean Goodman about some of his future projects such as the flat-screen, portable, pocket-size TV which should hit the streets later this year for around £50. He also spoke about his electric car idea and a distant objective which is to produce an artifically intelligent robot.

Coming up

Lots of great software for you to RUN on your Spectrum, ZX81 and ZX80 this issue.

For the ZX81 we have some smashing games as well as domestic, business and utility programs. Remember the Muncher program in the last issue of ZX Computing — well, if you were gnashing your teeth because you were a ZX81 owner and didn't really fancy doing the conversion from the Spectrum version, never fear, because Robert Turner has done the job for you. For all would-be rock guitarists, there's a program for you to draw guitar chords on-screen illustrating the finger positions you'll need to make those crashing chords. You'll also find a very comprehensive business program called The profit prophet, which should help you to put your business in the black!

Spectrum users are in for a treat this issue with some great games, useful utilities and lots more. We present a massive program for the 48K Spectrum called Tourist trap. This is a full scale board game for you to play with one of your friends which has you blazing the tourist trail. There are also the usual selection of space games and other arcade diversions, as well as a couple of Spectrum utilities, Toolbox trio, and an article from Timedata's Mike Lord, Spectrum streams.

Of course, our reviewers have been busy sifting through the piles and piles of great software that has been brought out onto the market over the last months. James Walsh has been busily inspecting the Spectrum software scene whilst Nick Pearce has been looking at how to create high resolution graphics on your ZX81.

If you want to check out what you, the reader, think of the various software packages available, then look no further than Reader's reviews. And if you don't like what you read there, or you disagree with one of our regular software reviewers on your favourite tape, then please get writing and tell the world — if it's published you'll get your software free!

Moving along

Another new feature is starting this month in the shape of The 1K corral. In this area of the magazine I would like to attract users of the ZX81 to contribute 1K programs which illustrate good programming techniques to make the best use of the limited memory space. Obviously, these programs can be games, simple business or domestic routines — the only critera set is that they should RUN in 1K.

It may have been a long time since you wrote a program within the confines of a 1K memory space or you may just be starting off your career in the hobby of computing — either way you may discover you can find out a great deal of economic programming techniques by studying these programs. If you feel you would like to contribute to The 1K corral, why not send in your programs with an explanation of what makes them special.

Contributions

We are always on the lookout for good programs and articles for future issues of *ZX Computing,* and where better to look than to our own readers. If, when reading through the magazine, you think you can write programs as well, or better than, our present contributors, then let's hear from you.

All contributions are, of course, paid for at very competitive rates. So if you've got your eye on a new ZX add-on or you'd just like to supplement your pocket money, get writing! It is vital, though, that all the programs you send us are totally original, and not 'borrowed' or 'adapted' from other magazines or books. (When Tim Hartnell was sitting in the Editor's chair, he even received 'original' contributions he himself had written for his own books!)

Any kind of program (business, domestic, educational, or just fun) will be welcomed, but particularly those which use ZX BASIC in clever and efficient ways, or those which employ certain routines which can be re-used on other programs.

Program listings are vital, along with a clear explanation of how the program is constructed, what it does and what the user can expect to see once the program is RUN (a screen dump is particularly valuable in this respect). When submitting Spectrum programs, it is very important to remember to enclose a cassette of the program as well as the listing, as this will allow us to check the program before publication.

Exit stage right . . .

Well, the weather has finally broken and (touch wood!) it looks as though it might be a nice summer. Still, I hope this magazine does inspire you not to ignore your computer for the sun. So, have a nice summer *and* make the most of micro with *ZX Computing.*

Roger Munford.

Your number's up

Dear ZX Computing,
The investigation of prime numbers must be one of the least useful of applications for a computer and yet it appears to have a fatal fascination! Using a Spectrum it took me a little over eight hours to establish the fact that the 10,000th prime is 104,723. We then put the problem to a TMS 9900 16-bit microprocessor. This came up with the same result — but took 2¼ minutes!

It then went on and found the 100,000th prime to be 1,308,383 in 62 minutes and the 350,000th prime to be 5,299,493. This took 6¼ hours! I am now intensively learning machine code so that I can see how long the Spectrum will take to do similar calculations.

Have any of your readers tried this task in machine code?
Yours faithfully,

D Gold,
London N12.



Fantasy, cont . . .

Dear ZX Computing,
I write with reference to your recent letters in the April/May issue of *ZX Computing* concerning the 'Fantasy Island' game from Psion Software's Sorcerer's Island package. I have discovered four things about the program which may cause some of your readers some problems.

1) Never use the instruction 'OPEN' as this is interpreted by the program as 'OUT' and will stop the game. Always use 'ENTER'.
2) Upon becoming Monster-Bone grade 10, you will find it necessary to type CONT as the line containing this information only allows for a single digit.
3) Never try to 'ZAP', 'ZZZ' or 'EXPL' any friendly animal as this will only cause the game to halt with an undefined variable.
4) Never ask for 'MAP' once inside a castle or cave as this just puts the computer into Fast mode. The map can only be generated once outside the building or cave.

Here are some more tips on playing the game. Try the command 'L' or 'LOOK'. Also, a Robot Marked Fight can be used once only unless you are carrying the correct medal.

I hope this information proves of interest to anyone attempting this game. Myself, I am currently Monster-Bone grade 24 and have escaped from the Island with 4,000 life points and 12,000 treasure points left. This feat was achieved after several hours of play!
Yours faithfully,

T McGowan,
Regents Park,
Southampton.



To the bitter end . . .

Dear ZX Computing,
I read with interest the review on The Hobbit in the April/May issue of *ZX Computing* and feel that I must write. Even though I have at last managed to finish the game, I still enjoy playing it and find it well worth the money.

I quote the last few sentences of the adventure to prove that I really did finish!

"A cheering crowd of dwarves, hobbits and elves appear. Led by Gandalf they carry you off into the sunset, proclaiming you hero of heroes and master adventurer!!!"

Also, please could you tell me which printer paper is the best value on the market for the ZX Printer as I intend to buy one. Thank you.
Yours faithfully,

Graham Walker,
Horncastle,
Lincoln.

● *Recommending the best printer paper is a little difficult, Graham, as to be quite honest, it is all pretty much of a muchness. The printer paper I myself have used in my involvement with Sinclair printers has all been of a uniform standard (and a high standard at that!). As for value for money, I think you'll just have to look around — often you can pick up some very good deals at the various ZX Microfairs and other similar events up and down the country. Ed.*



Bridging the gap

Dear ZX Computing,
The bridge problem incurred by R Wheen in your April/May edition of *ZX Computing* can be solved without recourse to machine code in just ten lines of BASIC:

```
10   LET A$ = "TJQKA"
90   LET I=O
100  LET I$ = INKEY$
110  IF I$>"9" OR I$<"2"
THEN GOTO 140
120  LET I=CODE I$-28
130  GOTO 180
140  FOR N=1 TO 5
150  IF A$(N)=I$ THEN LET
I=N+9
160  NEXT N
170  IF I=O THEN GOTO
100
```

As written, this will input a single character as a string (line 100) and if it is within the range two to nine, the variable I will become that number (lines 110 and 120). If the input is outside that range, the program goes through a loop checking the input with each character of the string A$. Then if it finds a match, it puts an appropriate value from ten to 14 into I (lines 140 to 160).

If I is still at zero, ie no match has been found because an invalid character was entered initially, then a new input is requested (line 170).

So, when the routine is complete, the variable I will have a value from two to 14 depending on whether the numbers two to nine or letters T (ten), J (Jack), Q (Queen), K (King) or A (ace) were input.

This type of routine can be used in any application where there is no direct mathematical relationship between the input and the value that the input has to the program, for instance when the '5', '6', '7' and '8' keys are used to control movement.
Yours faithfully,

ADV Barnett,
Watford,
Herts.

Your good health!

Dear ZX Computing,
The British Primary Health Care Group (PHCG) is anxious to help co-ordinate the efforts of all those who are finding uses for Sinclair personal computers in General Practice and Primary Care.

We hope to try and prevent the inevitable duplication that will occur, by setting up a subgroup to run a medical software library, assist novices and run meetings around the country. The library programs will be available free to members. Typically they will be small practice accounting packages, morbidity analysers, rotas and small databases for vaccination recall.

Membership will be £6.00 pa, including a bi-monthly newsletter. If you are interested in joining, or more importantly, participating in this group, please contact me at the address below.
Yours faithfully,

Dr N Robinson,
Spectrum Organiser,
The Surgery,
255 Eastcote Lane,
S Harrow,
Middlesex.

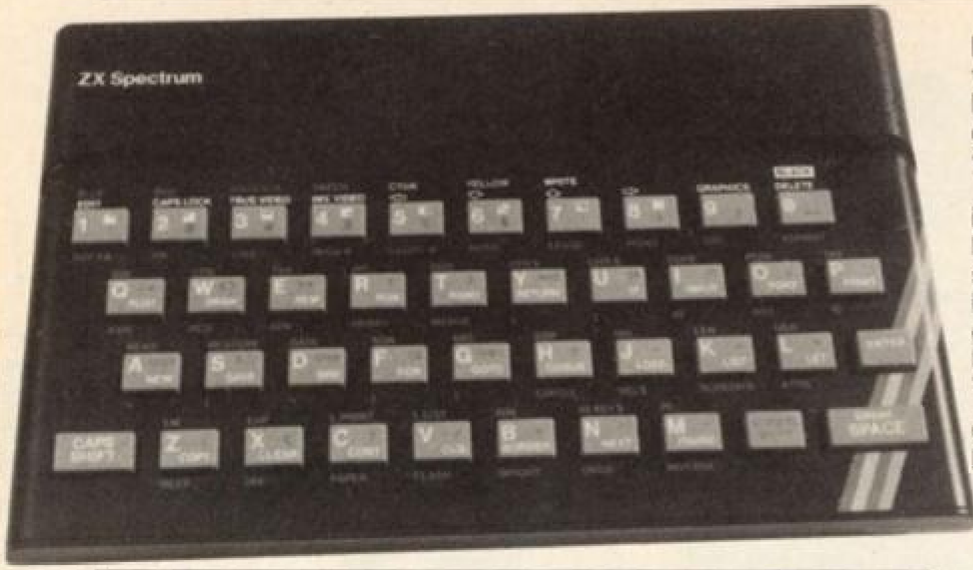


Record breaker

Dear ZX Computing,
I am writing to tell you of my high score on Imagine's Arcadia game. I managed to score 81,467 before I lost my last life and had achieved my 80th screen. Is this a record?

Arcadia is, in my opinion, one of the best games available for the Spectrum, and I would recommend it to anyone.
Yours faithfully,

Warren Speed,
Middlesborough,
Cleveland.



Mental block?

Dear ZX Computing,
I wonder if any of your readers would be interested in a block deletion program I have written for the 48K Spectrum.

Merged with any listing this will enable you to choose and delete any block of program lines. As the final action of deleting is not accomplished until you edit out (in the usual way) the first line you have chosen, the program can delete itself when you are finished with it!

The line numbering, of course, is arbitary but is best chosen well up into the 9900s to be clear of most ordinary listings. Only six lines are used so it can be fitted in between normal 10 line increments.

When loaded, typing 'GO TO 9911' will cause an input request for the first line of the block that you wish to delete. After this a request is made for the last line to be deleted. The program will then RUN. Finally you will be asked to type in the first line number again to be followed by 'Enter'. Hey presto . . . they are gone forever (so if you might want them again make sure the whole listing is on tape or printer!).

The program works as follows. Line 9912 uses system variable 23635 (it's in 'the book') to find the start of the BASIC. This is a two byte number with the most significant byte second (23636). PEEKing the value of this will give the first line number in the program. This is done in the second part of line 9013 and a check is made to see if this is the same as the starting line you have chosen. If it is, a variable 'start' is designated.

Also in line 9913, we PEEK at the second pair of bytes in the line which will give us the number of program bytes in the rest of the line. We call this YT.

Line 9914 checks to see if we have reached the last line requested. If we have, it adds YT + 4 (remember the first four bytes were not in the length) to the value of x and gives this value to a variable 'stop'. If we have reached a stop then we are put on the last line of the program.

If not, line 9915 increments x (the value of the line number) by YT + 4 and the program starts the loop again.

Line 9916 works out the total number of bytes involved and POKEs this value into the second two bytes of the first line to be deleted. The Spectrum now thinks that the first line is that long and when you edit out that line the whole lot will go!

STOP is only really needed if there is likely to be some lines following . . . perhaps say, a renumber routine . . . because without it the program will run on into those lines.

Your faithfully,

Colin Gooch,
Ilminster.

```
9911 REM
  BLOCK DELETE. C.N.GOOCH

9912 LET x=PEEK 23635+256*PEEK 2
3636: INPUT "ENTER FIRST LINE FO
R ERASING";A: INPUT "ENTER LAST
LINE FOR ERASING";B
9913 LET YT=PEEK (X+2)+256*PEEK
(X+3): IF PEEK X*256+PEEK (X+1)=
A THEN LET START=X
9914 IF PEEK X*256+PEEK (X+1)=B
THEN LET STOP=X+YT+4: GO TO 9916
9915 LET X=X+YT+4: GO TO 9913
9916 LET LENGTH=STOP-START-4: PO
KE START+2,LENGTH-256*INT (LENGT
H/256): POKE START+3,INT (LENGTH
/256): CLS : PRINT AT 10,0; FLAS
H 1;"NOW TYPE IN """;A;""" AND E
NTER"
9917 STOP
```



Computer corruption?

Dear ZX Computing,
While developing a machine code routine on my issue II 48K Spectrum, I believe I may have found a bug in the ROM.

If you type CLEAR 32775 or a smaller number, certain memory locations above 32768 begin to corrupt, seemingly picking up I/O signals.

For example, if you type:

```
10 CLEAR 30000
20 POKE 40069
30 PRINT CHR$ PEEK
40069
40 GOTO 30
```

you will find characters other than CHR$ 0 appear.

However, I have found a way of correcting this problem. If you add 128 to the machine code I register before typing the CLEAR statement, then type RANDOMIZE USR 0 to re-start the computer, you can then type:

```
10 FOR n=30000 TO
30004
20 READ x
30 POKE n,x
40 NEXT n
50 RANDOMIZE USR
30000
60 DATA 62,191,237,71,
201
```

Delete the above program line by line (don't use NEW as it will reset the I register) and then type the first program in again.

I would be grateful to know if anyone else has experienced this problem.

Yours faithfully,

P Bown,
Blunsdon,
Swindon.

Author's correction

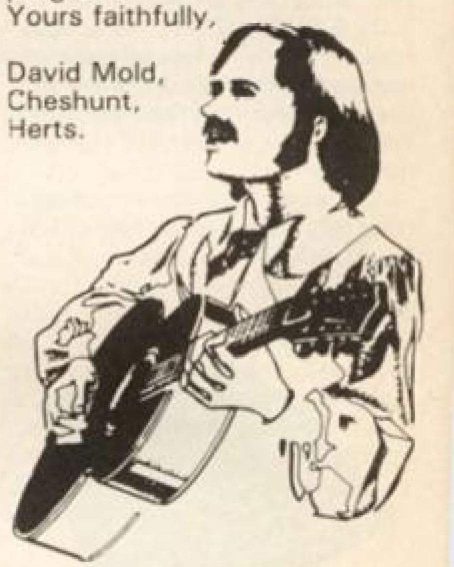
Dear ZX Computing,
It was great to see my program 'User character set' in the April/May issue of *ZX Computing*. However, I noticed a small error in the program at line 270.

This line causes the program to skip the routines for entering the character codes. Deleting this line will cure the 'bug'.

Many apologies for this error and I hope it didn't spoil your readers' enjoyment of the program.

Yours faithfully,

David Mold,
Cheshunt,
Herts.



Sound's great

Dear ZX Computing,
One evening whilst fiddling about with my ZX81 I discovered sound! Yes, with just a ZX81 and a standard black and white portable TV. Try this for the highest clear note possible:

```
10 SLOW
20 FAST
30 GOTO 10
```

RUN it and set your TV channel to approximately 35 and turn the volume up. Great eh?

I then tried to write a program which would allow you to select several different notes, but the more notes one makes available, the lower the notes become. So I tried different notes. Try this for a terribly high note in Fast mode:

```
10 CONT
20 GOTO 10
```

After much experimentation I came to the conclusion that you could get clear but low notes from SLOW and FAST, and high but distorted notes from REM in Fast mode. I chose REM for my final program which follows.

As you can see by the uneven distribution of everything the tuning of the notes relies on many factors. RUN it and play with the keys '1' to '8' and you should find you have something fairly near a standard octave.

Yours faithfully,

John Goldie,
Dumfries,
Scotland.

```
5   FAST
10  IF INKEY$ = "8" THEN GOTO 30
20  GOTO 50
30  REM
35  REM
40  GOTO 10
50  IF INKEY$ = "7" THEN GOTO 70
60  GOTO 120
70  REM
80  GOTO 50
120 IF INKEY$ = "6" THEN GOTO 150
130 GOTO 170
150 REM
160 GOTO 120
170 IF INKEY$ = "5" THEN GOTO 190
180 GOTO 250
200 REM
210 GOTO 170
220 IF INKEY$ = "4"THEN GOTO 240
230 GOTO 270
240 REM
250 REM
260 GOTO 220
270 IF INKEY$ = "3" THEN GOTO 290
280 GOTO 310
290 REM
295 REM
300 GOTO 270
310 IF INKEY$ = "2" THEN GOTO 330
320 GOTO 360
330 REM
335 REM
340 REM
350 GOTO 310
360 IF INKEY$ = "1" THEN GOTO 380
370 GOTO 10
380 REM
390 REM
395 REM
400 GOTO 360
```



Third time lucky

Dear ZX Computing,

I am now on my third Spectrum — the first packed up due to overheating problems and the second gave appalling displays, with colour fringing, rippling verticals, etc.

Out of despair, I invested £1.00 in the display instructions from Fountain Computers which were mentioned in your April/May issue. They really are quite excellent and I now have a fine display. I feel it's a shame that Sinclair couldn't manage to produce such a sheet as part of their own instructions.

Also, in the April/May issue, a reader suggested using a CLEAR instruction to remove machine code from the memory. This is OK but it doesn't shift user-defined graphics and you also have to remember the different RAMtop addresses for the 16K and 48K versions of the Spectrum. I suggest readers use the single instruction RANDOMIZE USR 0 which will clear the lot out — BASIC, machine code and UDGs all in one swoop.

Yours faithfully,

DC Oates,
Tamworth,
Staffs.

Two of a kind

Dear ZX Computing,

I have written two subroutines for my ZX81 which your readers might be interested in. One is for drawing reasonably straight lines on the screen and the other can be used for calculating the amount of memory left unused.

The first routine draws a line between two points, (X,Y) and (XI, YI). There is a program for this in the Sinclair ZX81 manual, but this one is shorter:

```
10  LET A = XI - X
20  LET B = YI - Y
30  LET H = SQR (ABS A *
    * 2 + ABS B * * 2)
40  FOR C = I TO H
50  PLOT X + (A/H) * C,Y +
    (B/H) * C
60  NEXT C
```

The second routine is in machine code. I have placed the code in a REM statement, but it could be placed elsewhere. One alternative place is above RAMtop. If it is placed above RAMtop, line 10 can be changed to 17325 if using 1K or 30000 if using 16K.

This program takes account of memory used for all purposes so, if you are taking account of memory used by variables, use 'GOTO 1' instead of 'RUN'.

(a) Enter:

```
1   REM 0123456789012
    3456789012345
10  LET A = 16514
20  FOR B = A TO A + 13
30  INPUT C
40  POKE B,C
50  NEXT C
```

(b) RUN this and Enter (taking ',' as Newline):

30,0,237,122,237,75,28,
64,237,66,68,77,201,

(c) Delete lines 10 – 50 and add:

```
2   PRINT "MEMORY LEFT:
    ";USR 16514;"BYTES"
3   STOP
```

Hope this may be of use to your readers.

Yours faithfully,

Alastair McKinstry,
County Dublin,
Eire.



Byting bugs

Dear ZX Computing,

I'm afraid I have found a couple of minor errors in my Spectramon program. However, I have two solutions to these problems:

1) When the Spectrum tries to disassemble close to the top limit of memory, because of the way in which the Z80 instruction set is constructed we may have to 'look ahead' by up to four bytes. If you are at location 65533 and this 'look ahead' occurs it will try to PEEK beyond the range of memory. This causes an 'out of range' error. There is no true solution without major alteration of the program. However, a simple 'fix' can be achieved by changing line 605 to read:

```
605 IF LOC 65532 THEN
PRINT "End of memory.";:
POKE 23560,32: GO TO
610: REM Pretend SPACE was
typed
```

2) The other problem in the program is far more subtle and occurs when the Spectrum tries to wrap around its memory map going from 65535 back to zero. This shows up as a subscript error when using the hexadecimal conversion routine. This can easily be cured with the addition of the line 3435:

```
3435 IF C>65535 THEN LET
C = C - 65536
```

Hopefully these two solutions will end all your worries with my Spectramon program.

Yours faithfully,

Simon Goodwin,
Hereford.



Stop press

Dear ZX Computing,

Please could I announce within your pages that I am considering setting up a newsletter for all owners of the ZX Spectrum. If anyone would be interested in this project and requires further information, could they please send a stamped addressed envelope to the address below.

John Grain,
Wychwood,
School Road,
Finstock,
Oxford OX7 3DJ.

Muncher II

Robert Turner of Gwent presents the 16K ZX81 adaptation of his arcade action game, Muncher.



In the June/July issue of *ZX Computing*, we were able to publish the program Muncher — a Spectrum version of the popular arcade game of the dot-eating kind. For all those of you with 16K ZX81s who have yet to convert this program for your machine, the original author, Robert Turner, has done the job for you!

For those not familiar with this 'infamous' game, you control a small character, an arrow, which travels around a small maze eating dots as it goes. That's not quite the end of the story though! As in all good arcade games there should be the omnipresent monsters — and this game is no exception. You are chased around the maze by two monsters eager to halt your progress.

However, all is not lost as there are power pills situated in the corners of the maze which, when consumed, give your character the ability to destroy the monsters. You'll know when the monsters are vulnerable as they develop 'eyes'. When you have eaten a power pill, don't hang around as the monsters try to escape.

You score one point each time you eat a dot, and power pills and monsters are worth 10 points. Every now and then a '£' sign will appear under the monster's den and this too is worth 10 points if consumed.

Variables

The variables used in the program, Muncher II, are as follows:

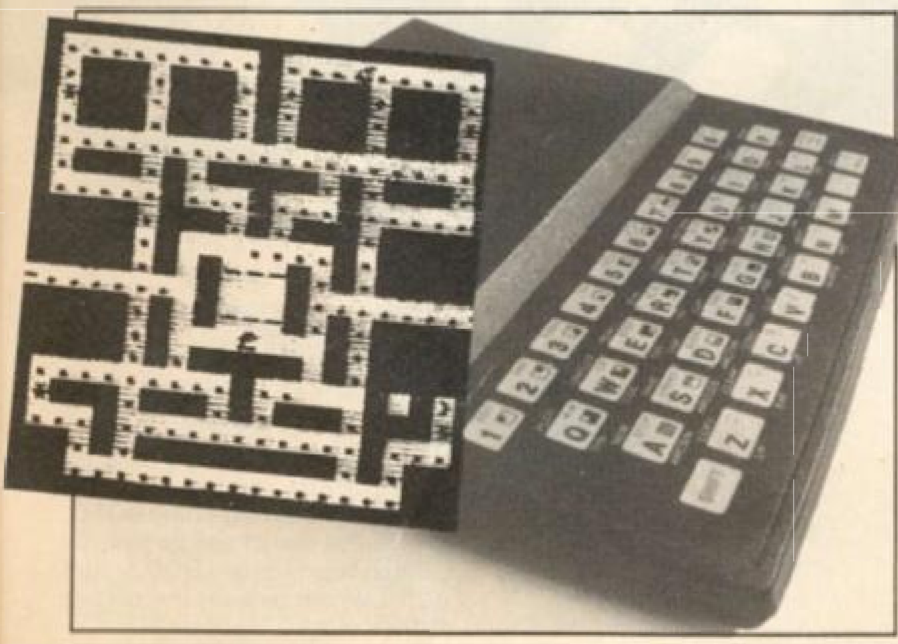
S — Score.
HS — High score.
T — The score when the screen has been cleared.
B$ — The variable which stores the maze.
COUNT — If this variable is less than 30 the monsters can be eaten. If it is more than 30 the monsters can eat your character.
LIVES — The number of lives you have left.
Y and X — The position of your character.
A$ — The shape of your character.
GX and GY — The position of the first monster.
GX1 and GY1 — The position of the second monster.
C — This variable controls the movement of the monster. If C = −1 then the monster moves away from your character, if C = 1 then the monster chases you.
D$ — The shape under the first monster.
E$ — The shape under the second monster.
A — The skill level.
N — Allotted for general use.

So, dont just sit there — type in the program and watch out for the monsters! ▶




```
1 LET S=0
2 LET HS=0
3 LET T=180
4 DIM B$(21,21)
5 LET COUNT=30
6 LET LIVES=3
7 GOSUB 7000
8 LET CHECK=1
9 LET E=0
10 LET R=1
11 LET B$(1)="█████████████████████"
20 LET B$(2)="█.........█.........█"
30 LET B$(3)="█.███.███.█.███.███.█"
40 LET B$(4)="█*███.███.█.███.███*█"
50 LET B$(5)="█.███.███.█.███.███.█"
60 LET B$(6)="█...................█"
70 LET B$(7)="█.███.█.█████.█.███.█"
80 LET B$(8)="█.....█...█...█.....█"
90 LET B$(9)="█████.███.█.███.█████"
100 LET B$(10)="█████.█.......█.█████"
110 LET B$(11)="█████.█.█---█.█.█████"
120 LET B$(12)="-.......█   █.......-"
130 LET B$(13)="█████.█.█---█.█.█████"
140 LET B$(14)="█████.█.... ..█.█████"
150 LET B$(15)="█████.█.█████.█.█████"
160 LET B$(16)="█.........█.........█"
170 LET B$(17)="█*███.███.█.███.███*█"
180 LET B$(18)="█...█...........█...█"
190 LET B$(19)="███.█.█████████.█.███"
200 LET B$(20)="███...............███"
210 LET B$(21)="█████████████████████"
220 FOR N=1 TO 21
230 PRINT AT N,1;B$(N)
240 NEXT N
250 LET Y=14
255 LET E$=" "
260 LET X=12
265 LET D$=" "
270 LET A$=">"
275 LET C=1
280 LET GX=12
285 LET GY=12
290 LET GX1=12
295 LET GY1=11
300 PRINT AT GX,GY;"█"
310 PRINT AT GX1,GY1;"█"
320 PRINT AT Y,X;A$
325 PRINT AT 0,0;"LIVES:";LIVES
;AT 0,19;"HI-SCORE:";HS
330 IF INT (RND*50)=0 THEN GOSU
B 1000
335 PRINT AT Y,X;" "
340 IF INKEY$="8" OR (B$(Y,X+1)
="-" AND R=1) THEN GOTO 1500
350 IF INKEY$="5" OR (B$(Y,X-1)
="-" AND R=-1) THEN GOTO 1600
355 IF INKEY$<>"5" AND INKEY$<>
"6" AND INKEY$<>"7" AND INKEY$<>
"8" AND INKEY$<>"" THEN GOTO 400
0
360 IF INKEY$="7" THEN GOSUB 17
00
365 IF INKEY$="6" THEN GOSUB 18
00
370 IF B$(Y,X+R)<>"-" AND B$(Y,
X+R)<>"█" THEN LET X=X+R
371 IF B$(Y+E,X)<>"█" THEN LET
Y=Y+E
375 IF B$(Y,X)="*" THEN GOSUB 2
000
380 IF B$(Y,X)="." THEN LET S=S
+1
390 IF B$(Y,X)="£" THEN LET S=S
+10
395 IF B$(Y,X)="£" THEN LET T=T
+10
400 LET B$(Y,X)=" "
405 PRINT AT 0,8;"SCORE:";S
410 PRINT AT Y,X;A$
415 IF S=T THEN GOTO 5000
420 PRINT AT GX,GY;D$;AT GX1,GY
1;E$
425 IF RND<A THEN GOTO 436
430 IF GY<X AND B$(GX,GY+C)<>"█
" AND B$(GX,GY+C)<>"█" THEN GOTO
3000
436 IF RND<A THEN GOTO 450
440 IF GY>X AND B$(GX,GY-C)<>"█
" AND B$(GX,GY-C)<>"-" THEN GOTO
3020
446 IF RND<A THEN GOTO 456
450 IF GX<Y AND B$(GX+C,GY)<>"█
" THEN GOTO 3040
456 IF RND<A THEN GOTO 470
460 IF GX>Y AND B$(GX-C,GY)<>"█
" THEN LET GX=GX-C
465 IF RND<A THEN GOTO 474
470 IF GY1<X AND B$(GX1,GY1+C)<
>"█" AND B$(GX1,GY1+C)<>"-" THEN
GOTO 3060
474 IF RND<A THEN GOTO 478
475 IF GY1>X AND B$(GX1,GY1-C)<
>"█" AND B$(GX1,GY1-C)<>"-" THEN
GOTO 3080
478 IF RND<A THEN GOTO 485
480 IF GX1<Y AND B$(GX1+C,GY1)<
>"█" THEN GOTO 3100
486 IF RND<A THEN GOTO 500
490 IF GX1>Y AND B$(GX1-C,GY1)<
>"█" THEN LET GX1=GX1-C
500 LET COUNT=COUNT+1
510 IF COUNT>=30 THEN LET C=1
520 IF C=-1 THEN PRINT AT GX,GY
;""""
525 IF C=1 THEN PRINT AT GX,GY;
"█"
530 IF C=-1 THEN PRINT AT GX1,G
Y1;""""
```

```
535 IF C=1 THEN PRINT AT GX1,GY1;"█"
540 IF GX=Y AND GY=X THEN GOTO 9000
550 IF GX1=Y AND GY1=X THEN GOTO 9000
560 LET D$=B$(GX,GY)
570 LET E$=B$(GX1,GY1)
580 LET CHECK=1
600 GOTO 330
1000 IF B$(14,11)="£" THEN RETURN
1010 PRINT AT 14,11;"£"
1020 IF B$(14,11)="." THEN LET T=T-1
1030 LET B$(14,11)="£"
1040 RETURN
1500 PRINT AT Y,X;" "
1510 LET A$=">"
1520 IF B$(Y,X+1)="-" THEN LET CHECK=0
1530 IF CHECK=0 THEN LET X=2
1535 IF CHECK=0 THEN GOTO 375
1540 IF B$(Y,X+1)<>"█" THEN LET R=1
1545 IF B$(Y,X+1)<>"█" THEN LET E=0
1550 GOTO 370
1600 PRINT AT Y,X;" "
1610 LET A$="<"
1620 IF B$(Y,X-1)="-" THEN LET CHECK=0
1630 IF CHECK=0 THEN LET X=20
1635 IF CHECK=0 THEN GOTO 375
1640 IF B$(Y,X-1)<>"█" THEN LET R=-1
1645 IF B$(Y,X-1)<>"█" THEN LET E=0
1650 GOTO 370
1700 PRINT AT Y,X;" "
1710 IF B$(Y-1,X)<>"█" AND B$(Y-1,X)<>"-" THEN LET E=-1
1715 IF B$(Y-1,X)<>"█" AND B$(Y-1,X)<>"-" THEN LET R=0
1720 LET A$="A"
1730 RETURN
1800 PRINT AT Y,X;" "
1810 IF B$(Y+1,X)<>"█" AND B$(Y-1,X)<>"-" THEN LET E=1
1815 IF B$(Y+1,X)<>"█" AND B$(Y-1,X)<>"-" THEN LET R=0
1820 LET A$="V"
1830 RETURN
2000 LET S=S+10
2010 LET C=-1
2020 LET B$(Y,X)=" "
2030 PRINT AT Y,X;A$
2040 LET T=T+10
2050 LET COUNT=0
2060 RETURN
```



```
3000 LET GY=GY+C
3010 GOTO 470
3020 LET GY=GY-C
3030 GOTO 470
3040 LET GX=GX+C
3050 GOTO 470
3060 LET GY1=GY1+C
3070 GOTO 500
3080 LET GY1=GY1-C
3090 GOTO 500
3100 LET GX1=GX1+C
3110 GOTO 500
4000 LET R=0
4010 LET E=0
4020 GOTO 360
5000 CLS
5005 PRINT AT 10,31;"*"
5010 FOR N=1 TO 27
5020 PRINT AT 10,N;" █   >"
5025 REM SHEET CLEARED
5030 NEXT N
5040 FOR N=27 TO 1 STEP -1
5050 PRINT AT 10,N;"""   < "
5060 NEXT N
5070 LET T=T+180
5080 GOTO 8
7000 PRINT AT 0,12;"MUNCHER II";TAB 11;"▀▀▀▀▀▀▀▀▀▀"
7010 PRINT AT 9,0;"--------------------------------"
7020 PRINT AT 11,3;"SELECT SSILL LEVEL (1-5)"
7030 PRINT TAB 7;"(5 IS THE EASIEST)"
7040 PRINT AT 14,0;"--------------------------------"
7050 PRINT TAB 5;"    ROBERT TURNER 1983"
7060 LET A=CODE INKEY$-28
7070 IF A>5 OR A<1 THEN GOTO 7060
7080 LET A=A/10
7090 LET A=A+.1
7100 CLS
7110 RETURN
8000 IF GY<>X OR GX<>Y THEN GOTO 8060
8010 LET S=S+10
8020 LET T=T+10
8030 LET GY=12
8040 LET GX=12
8045 PRINT AT Y,X;A$
8050 GOTO 500
8060 IF GY1<>X OR GX1<>Y THEN GOTO 500
8070 LET S=S+10
8080 LET T=T+10
8090 LET GY1=11
8100 LET GX1=12
8105 PRINT AT Y,X;A$
8110 GOTO 500
9000 IF COUNT<=30 THEN GOTO 8000
9005 LET LIVES=LIVES-1
9010 FOR N=1 TO 10
9015 PRINT AT Y,X;A$
9016 FOR Q=1 TO 2
9017 NEXT Q
9018 PRINT AT Y,X;CHR$ (CODE A$+128)
9019 NEXT N
9020 IF LIVES<=0 THEN GOTO 9500
9025 CLS
9030 GOTO 210
9500 IF HS<S THEN LET HS=S
9510 PRINT AT 10,0;"HIT ANY KEY TO RESTART"
9520 IF INKEY$="" THEN GOTO 9520
9530 LET S=0
9540 CLS
9550 LET T=180
9560 LET LIVES=3
9570 GOTO 8
9998 LET A$="MUNCHER II"
9999 SAVE A$
```

Toolbox trio

Three BASIC utility programs for your ZX Spectrum, courtesy of Richard Sargent of Wantage.

The ability of the Spectrum to MERGE one program into another makes it very easy to tack one or more utility programs onto a BASIC program under development. Each utility program included in this article is a little longer than it need be because sensible prompts are included — however, these could be taken out if space is at a premium. Each program has been compacted to a reasonable number of lines so that it may be deleted fairly quickly when it is no longer required.

Hexadecimal/decimal conversion

Once you have entered the two routines which make up this program, you use the following inputs to access the utilities:

RUN 9000 enters the Hex to decimal conversion routine.
RUN 9011 enters the decimal to Hex conversion routine.

The program will prompt for the number to be converted. Should you wish to change the direction of conversion, you do not need to break and re-RUN the other program, you can simply input 'T' and '123456'. If you input '0', you stop the program.

PEEK and POKE

RUN 9020 will PEEK a specified memory location. The program will ask you if you wish to read a single byte or a double byte, and then returns with a decimal number in the range 0 to 255 in the case of the former and 0 to 65535 in the case of the latter.

RUN 9030 will POKE a decimal number in the range 0 to 65535 into a specified memory location. Numbers greater than 255 will automatically be entered correctly into two consecutive memory locations.



Attribute finder

This program will be of use to anyone investigating a BASIC program when they only have a black and white television available. It may also be useful to anyone who has colour blindness. The BASIC program under investigation is stopped with the Break key and then RUN 9040 is entered.

Immediately the global attributes are displayed — the BORDER colour, the default PAPER colour, the default INK colour and BRIGHT/NORMAL mode — together with the attribute number that was set by the last PRINT statement before the break.

Then the user is prompted for a row and column co-ordinates until '33' is entered, which will stop the program.

The Attribute finder program itself obtains the global attributes by PEEKing three locations in the Spectrum workspace. This is done in line 9041. Local attributes are picked up using ATTR(R1,C1) in line 9048.

The attribute number, held in N, is broken up into its component parts by the subroutine starting at line 9050. Notice the use of the computed GOSUBs in lines 9052 and 9053 which pick up the names of the colours.

1

PROGRAM ONE
HEX-DEC and DEC-HEX conversions.

```
9000 REM Hex to Dec Conversion
9001 PAPER 7: INK 0: CLS : PRINT
 "CAPS LOCK ON PLEASE."'"0 ABORT
s."'"T FOR DEC TO HEX."
9002 INPUT "HEX";H$: LET T=0: LE
T D=1: IF H$="0" THEN GO TO 9019
9003 IF H$="T" THEN GO TO 9011
9004 FOR P=LEN (H$)-1 TO 0 STEP
-1
9005 LET C=CODE (H$(D TO D)): LE
t D=D+1: IF C>=48 AND C<=57 THEN
 LET C=C-48: GO TO 9008
9006 IF C>=65 AND C<=70 THEN LET
 C=C-55: GO TO 9008
9007 PRINT "Try again" : GO TO 90
02
9008 LET T=T+C*16↑P
9009 NEXT P
9010 PRINT "HEX ";H$;" = ";T;" D
EC": GO TO 9002
9011 PRINT "0 ABORTS": PRINT "12
3456 FOR HEX TO DEC."
9012 LET A$="0123456789ABCDEF"
9013 INPUT "DEC ";Q: IF Q=0 THEN
 GO TO 9019
9014 IF Q=123456 THEN GO TO 9002
9015 IF Q>65535 OR Q<0 THEN PRIN
T "Try again": GO TO 9013
9016 LET D=INT (Q/4096): LET R=Q
-4096*D: LET E=INT (R/256): LET
R=R-256*E: LET H=INT (R/16): LET
 L=R-16*H
9017 PRINT "DEC ";Q;" = ";
9018 PRINT A$(D+1 TO D+1);A$(E+1
 TO E+1);A$(H+1 TO H+1);A$(L+1 T
O L+1);" HEX": GO TO 9013
9019 STOP
```

2

PROGRAM TWO
PEEK AND POKE WITH EASE

```
9020 PRINT "PEEKER"
9021 INPUT "SINGLE OR DOUBLE (S/
D)";A$: IF A$="0" THEN STOP
9022 INPUT "DEC ADDR = ";N: IF N
=0 THEN STOP
9023 PRINT "Address ";N;" contai
ns ";: IF A$="D" OR A$="d" THEN
PRINT PEEK N+256*PEEK (N+1): GO
TO 9021
9024 PRINT PEEK N: GO TO 9021
9030 PRINT "POKER"
9032 INPUT "DEC ADDR = ";N: IF N
=0 THEN STOP
9034 INPUT "DEC VALUE =";V: IF V
<=255 THEN POKE N,V: GO TO 9038
9035 POKE N,V-256*INT (V/256): P
OKE N+1,INT (V/256)
9038 PRINT "Address ";N;" contai
ns ";V: GO TO 9032
```

3

PROGRAM THREE
ATTRIBUTE FINDER

```
9040 REM ATTRIBUTE FINDER
9041 LET B=INT ((PEEK 23624)/8):
 LET A=PEEK 23693: LET T=PEEK 23
695: GO SUB 9063
9042 LET N=A: GO SUB 9050
9043 GO SUB 9055+B
9044 PRINT AT 19,0; INK 0;"GLOBA
L =";A;" LOCAL=";T;" BORDER=";B;
" ";AT 20,0;"PAPER=";P$;" INK=";
I$;" ";R$;AT 21,0;"Press 0 to qu
it, else continue.": PAUSE 0: IF
 INKEY$="0" THEN STOP
9045 GO SUB 9063
9046 PRINT AT 19,0; INK 0;"LOCAL
 ATTRIBUTE=";AT 21,0;"Enter 33 t
o quit."
9047 INPUT "ROW NUMBER IS ";R1:
INPUT "COLUMN NUMBER IS ";C1: IF
 R1<0 OR R1>21 OR C1<0 OR C1>31
THEN STOP
9048 LET N=ATTR (R1,C1): GO SUB
9050
9049 PRINT AT 19,16; INK 0;N;AT
20,0;"PAPER=";P$;" INK=";I$;" ";
R$: GO TO 9047
9050 LET R$=" NORMAL": IF N>=128
 THEN LET N=N-128
9051 IF N>=64 THEN LET N=N-64: L
ET R$=" BRIGHT"
9052 LET P=INT (N/8): LET I=N-P*
8: GO SUB 9055+P
9053 LET P$=C$: GO SUB 9055+I
9054 LET I$=C$: RETURN
9055 LET C$="BLACK ": RETURN
9056 LET C$="BLUE  ": RETURN
9057 LET C$="RED   ": RETURN
9058 LET C$="PURPLE": RETURN
9059 LET C$="GREEN ": RETURN
9060 LET C$="CYAN  ": RETURN
9061 LET C$="YELLOW": RETURN
9062 LET C$="WHITE ": RETURN
9063 FOR R=19 TO 21
9064 FOR C=0 TO 31: PRINT AT R,C
; PAPER 7; INK 0;" ": NEXT C: NE
XT R: RETURN
```

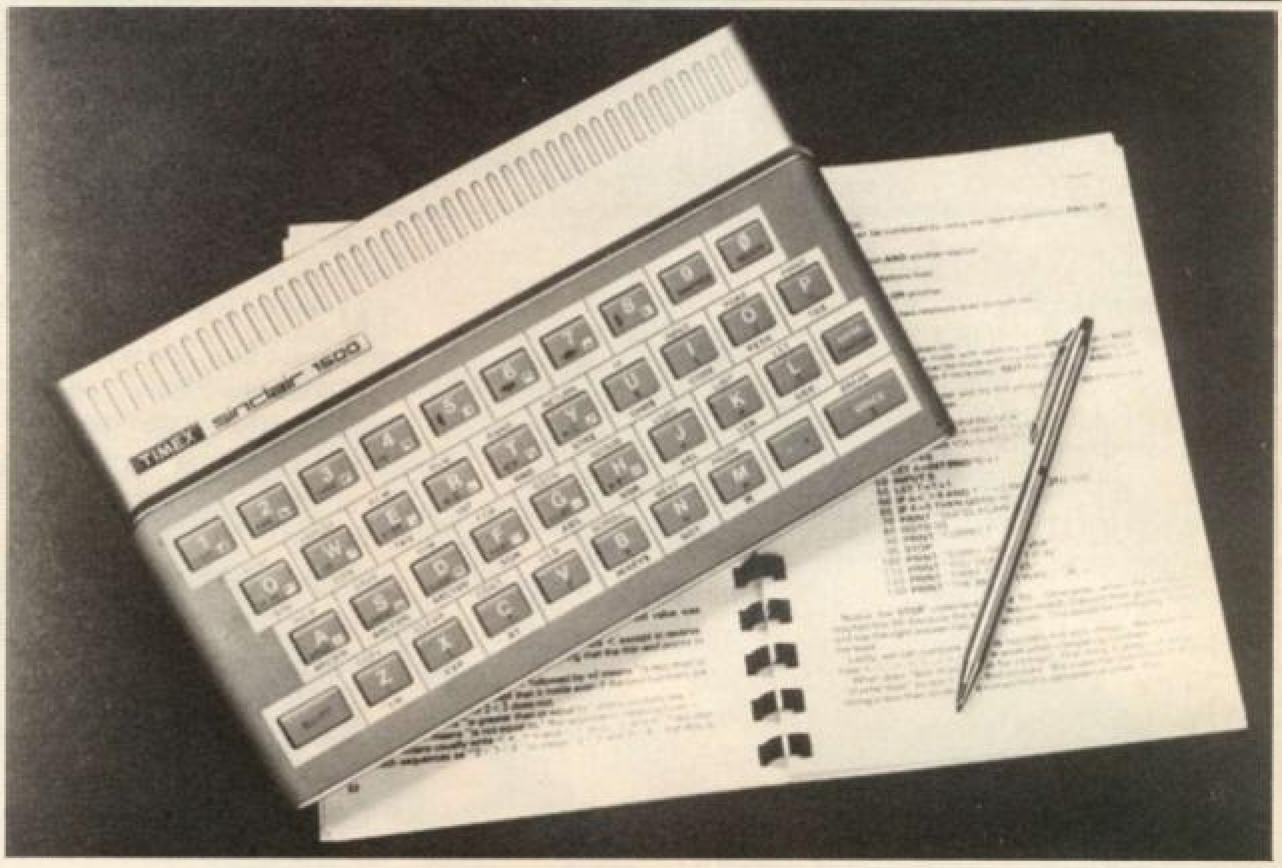
My kind of town

After a long delay, Timex in America have finally released their version of the Spectrum, known as the T/S 2000. Tim Hartnell was at the launch in Chicago for ZX Computing.

Imagine an electronics show which is five times larger than the PCW show in London, a show so big the organiser provide *buses* to move visitors from section to section. That's the Consumer Electronics Show held in Chicago each year.

Although it is just for the trade, that is for dealers who will sell to the public, this year's show attracted over 80,000 visitors. The hit of the show, in the computer section, was Coleco's Adam. This product combines a keyboard, processor unit, two keypad/joysticks on separate cables, daisy wheel printer plus double stringy-floppies (similar, we believe, to Sinclair's Microdrives) and all for around £400. Coleco's stock rose 15½ points on the New York stock exchange in a day as a result of the launch.

However, I was more interested in what Timex were doing. After some 18 months with the Timex version of the ZX81 (a 2K ZX81 called the Timex Sinclair 1000, or T/S 1000), Timex have managed to sell 600,000 of the machines in America. There are 750,000 VIC-20s in the States, with the T/S 1000 and Apple II taking equal second position. With a user base like that, Timex seem in a strong position to continue to hold their ground, Coleco notwithstanding.

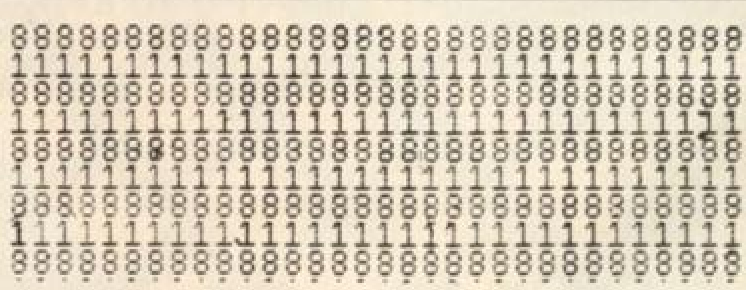


In good standing

The Timex stand was enormous, about the area of four-room flat, and it was dominated by giant pictures of the T/S 2000 and the T/S 1500. The T/S 1500 is essentially a ZX81, with 16K built-in, plus a Spectrum-like keyboard. The whole unit is silver, and looks very good indeed. Timex will be introducing it at around £45. That is a great price, compared to the ZX81, when you remember it has a Spectrum-like keyboard, and 16K onboard.

Daniel Ross, Vice President (they have such titles in business over there) of the Timex Computer Corporation, says he believes the T/S 1500 will produce as much excitement as the T/S 1000. He also stated that "the T/S 1000, T/S 1500 and T/S 2000 series colour computers, with the growing line of Timex peripherals and software, constitute the best price/value family of computing products available today." While some may argue with that, there seems little doubt that the Timex versions of Sinclair computers are pretty impressive.

The T/S 1500 is compatible with all of the peripherals and software available for the T/S 1000 (2K ZX81), including the 16K pack (a few POKEs and you've got a 32K computer) and the TS2040, a thermal printer developed by Timex to take the place of the silver paper machine we have in the UK.

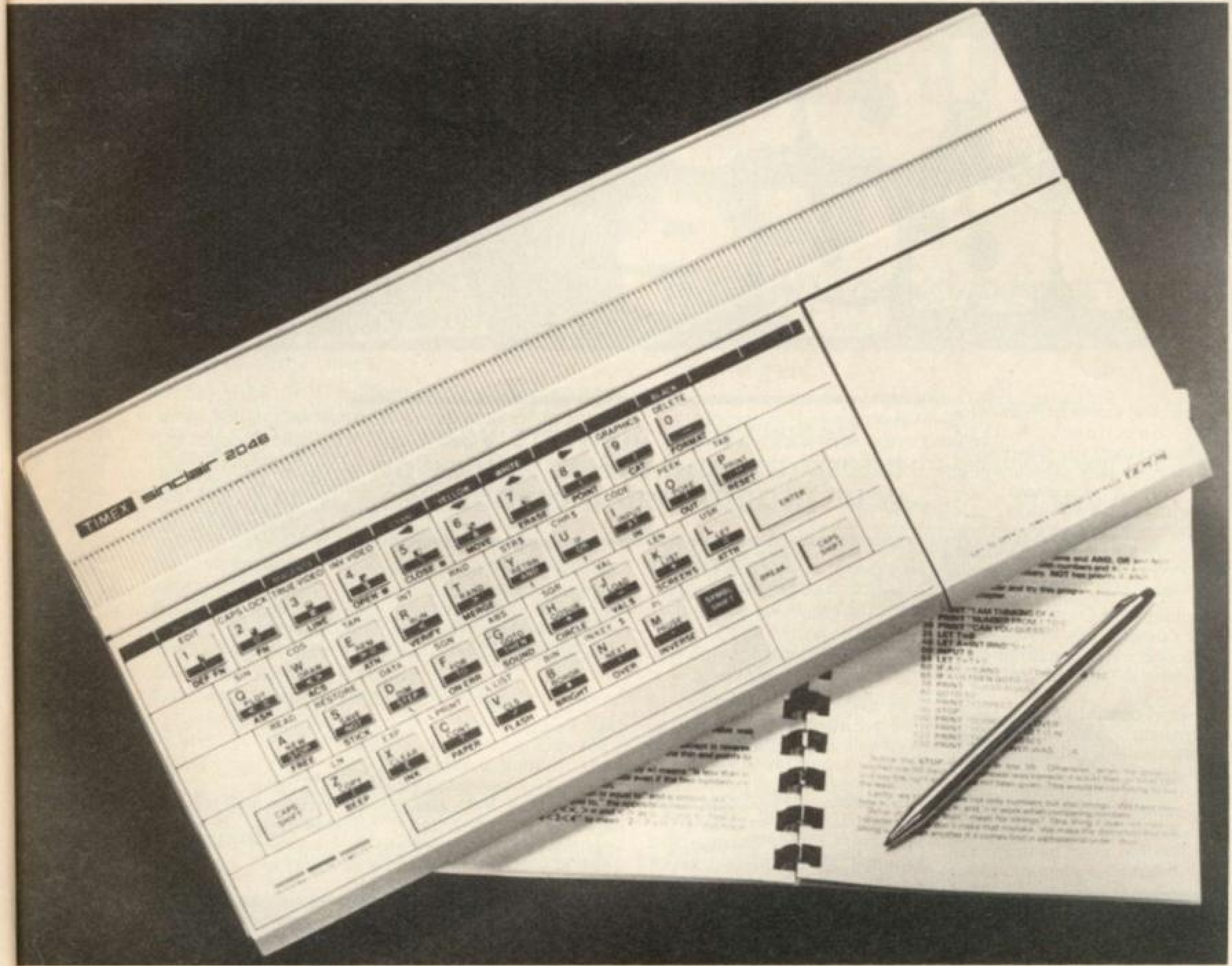


Sample output from the Timex printer.

Although the 100 or so software packs which Timex have made available in the US for the T/S 1000 and T/S 1500 are of interest (with most of the good items of software being written in Britain), the instant-load plug-in cartridges Timex are offering for the machines are really exciting. A small, wedge-shaped cartridge fits into a slot in a gadget which Timex sell to plug into the expansion area at the back of the machine where the RAM pack usually goes. Like plug-in cartridges on other machines, this means the program is available instantly, with no loading. The 'mini-cartridges', as Timex call them, cost between £5.00 and £17.00, depending on the program.

Here's the story

Although the T/S 1500 seems a vast improvement on the 1K ZX81, the T/S 2000 series of computers — the American versions of the Spectrum —



are a whole world apart. The story gets quite complicated here, so I'll try to explain it clearly. America will have *two* versions of the Spectrum. The 16K version will sell for around £100 and is much like our 16K Spectrum, with the following extras: five new commands (ON ERROR GOTO, RESET, FREE — to tell how much memory is left, STICK — to work the joystick, and SOUND — to trigger a three-channel synthesiser), a hole in the side to take a joystick, an on/off switch, a slot (with flip-up cover) to take the plug-in cartridges, and a new paint job in shiny silver.

The 48K version of this (called the T/S 2048) has all the above *plus* the ability to go into a second graphics mode which gives 64 characters across each line. This version sells for around £135.

It seems as though there will be little chance of these machines being available on the UK market. A Timex spokesman who I won't name (so that Uncle Sir Clive won't belt him one next time they meet in the States) said that Sinclair in the UK have shown no interest whatsoever in bringing any developments of Sinclair products back into the UK. "We offered him our printer," that spokesman said, "and he just wasn't interested. I guess that's because he didn't build it himself. I predict the same thing may well happen with the plug-in cartridges and the extra commands."

However, Timex themselves may not be as hot as they think. I managed to cause a couple of Timex executives a moment of embarassment by asking them to come with me to the T/S 2000s on display, and told them to watch as I typed in the new commands. To their discomfort, the machines on display (or at least the ones I tested) were only dressed-up Spectrums fitted with modulators to drive American TV sets. None of the exciting new commands actually worked. Instead, the keys produced such things as the Spectrum's pretty (but useless) curly brackets.

Sadly . . .

Finally, a rather sad note. About 100 yards beyond the Timex razzle-dazzle of chrome and giant pictures of the new computers, was a small little booth marked 'Sinclair'. In it, three somewhat bewildered people sat. On display was a ZX81 (*not* a T/S 1000), a UK Spectrum (modified to drive a US television), a copy of *The Hobbit* and *Scrabble*. "We are here to demonstrate that Sinclair Research is a separate company" I was told. "We need to show that Sinclair have not been taken over by Timex. And we're maintaining a public stance so we'll be ready for the next product."

"And what will that be?" I enquired politely.

"The flat screen TV . . . we hope," I was told.

Upstairs at the show, Casio were hammering nails into the coffin of that hope, with a crowd gathered around its 2¼ inch square TV which uses LCDs for a very clear screen.

The highlights of the show for me were Casio's little TV, the Coleco Adam and the T/S 2000 series of computers. It is strange that the three of them may well have more impact on Sinclair's fortunes in the coming year in the US than any other products.

Problem page



Peter Shaw answers your questions and offers advice on your programming techniques.

Peter Shaw, author of 'Games for your Spectrum', will be endeavouring to answer a selection of your programming (and other) problems you encounter on your ZX computer. Should you have any problems, why not send in your queries to the following address:

Problem page,
ZX Computing,
145 Charing Cross Road,
London WC2H 0EE.

Please try and include as much information about your particular problem, including screen dumps, listings, etc.

It must be appreciated that Peter will not be able to answer all of your queiries, but will choose a selection that reflect general problems that should affect you all.

Dear Peter,
After some months of studying the market of microcomputers for one that my spare capital would allow, I am now the owner of Sinclair ZX Spectrum (48K). An excellent unit, as is some of the software produced for it, but I have encountered an irritating problem. Many of the 'games' programs that I have obtained do not use the same keys for similar functions, ie I would have thought it obvious to use the cursor controls for movement. But no, programmers have other ideas, and the selection of games tapes that I have purchased offer differing control keys.

The problem of getting used to the new control keys is easily overcome, but the real problem occurs when I would like to use a joystick on the games. Of the joysticks I have looked at, none are compatible with the games I already have. Surely the answer is to have a standard — programmers write the programs to work on the cursor keys, and joystick manufacturers make their joysticks act on cursor inputs.

Malcolm Jay,
Chingford.

Malcolm,
The problem behind using the cursor keys is because they are so close together. You must admit that there is not a lot of room between the cursor keys, especially if you are using the standard Sinclair keyboard. If you are looking for a joystick which works with the cursor keys, then look no further than the AGF joystick, (AGF Hardware, 26 Van Gogh Place, Bognor Regis, West Sussex PO22 9BY). But, as you will find, most of the new 'popular' games will work with some of the more popular joysticks, ie the Kempston joystick, Fuller interface and Mikro-Gen joysticks. All three work on IN commands, so the keyboard doesn't come into it. Sinclair's joysticks, when they arrive, will work on the block of keys from 6-0, disregarding the cursor keys altogether. You will probably find most games written by the larger software houses will incorporate the Sinclair joystick for INKEY$, and one other joystick via the IN command (the Kempston is the most likely choice). So, Malcolm, I advise you to either invest in a Kempston joystick (Kempston Micro Electronics, Dept ZXCP, 180a Bedford Road, Kempston, Bedford MK42 8BL) or wait for Sinclair's own joystick. You might also like to investigate the new programmable joystick interfaces emerging onto the market; I believe AGF Hardware are releasing one such interface as you are reading this.

Dear Peter,
I am encountering an increasingly irritating problem with my ZX81. The connection of the 9V DC lead from the Power Pack into the computer has become very loose. This is causing programs to crash and the computer can not be used with any confidence. Can you suggest a solution to this annoying problem?

Edward Parsons,
Stourbridge,
West Midlands.

Edward,
The problem you are having is not uncommon, through persistant unplugging and setting up; the 'spring' which holds the jack plug in place has become loose. The problem is easily cured, however, but it will involve opening your case, and if you would rather not open it yourself then take it to your nearest electrical store who would be able to do the job in a couple of minutes. Firstly, unplug all leads from your '81. Unscrew all the screws you can see in the base, then lift up the foam pads. Carefully open the case and locate the 9V DC plug, then using your screwdriver or similar gently push down the metal bars which run across the top until they are firmly down. While you are in the case, do the same to the other plugs, ie EAR and MIC, so that they are tight as well. Carefully put the computer back together and tighten all the screws, and the jack plugs should not wobble any more.

Dear Peter,
The articles in *ZX Computing*, on the development of the Checkers type game contain a line which has me completely baffled:

```
6070 LET  Y = -9 * (Y =
     -11) + 9 * (Y = -9)
     + 11 * (Y = 9) +
     (Y = 100)
```

I have never met this form of notation before, could you please explain what is happening?

Hugh Neilson,
Kettering,
Northants.

Hugh,
This problem is difficult to explain but easy to understand. If the expression, ie Y = −11, is true then the bracket takes the value of one, ie if Y does equal −11 then the line will read:

```
6070 LET Y = -9 * 1 + 9
     * 0 + 11 * 0 + 0
```

You will gather that if the contents of the bracket is false then it takes the value zero.

For example try:

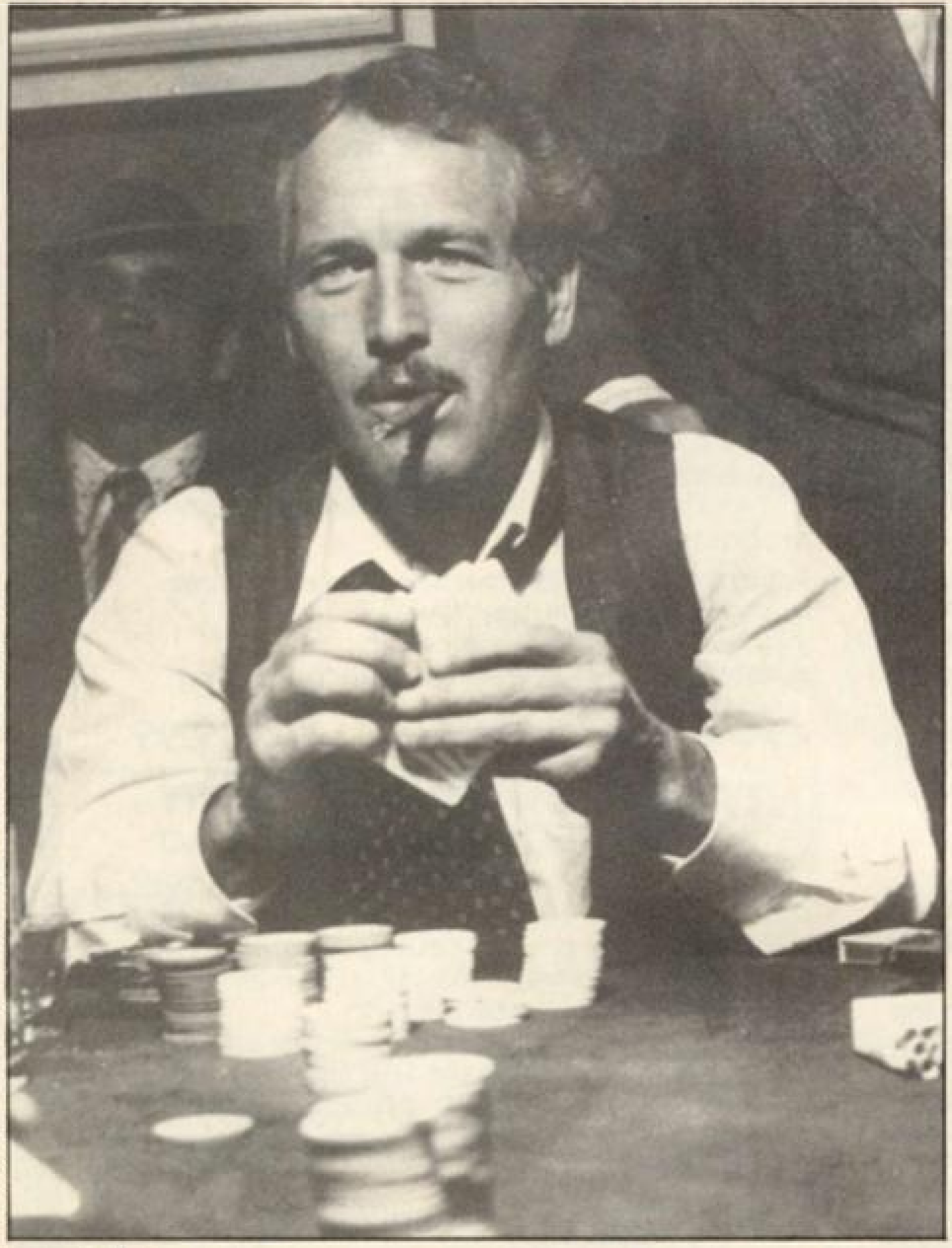
```
PRINT (2 = 2)
```

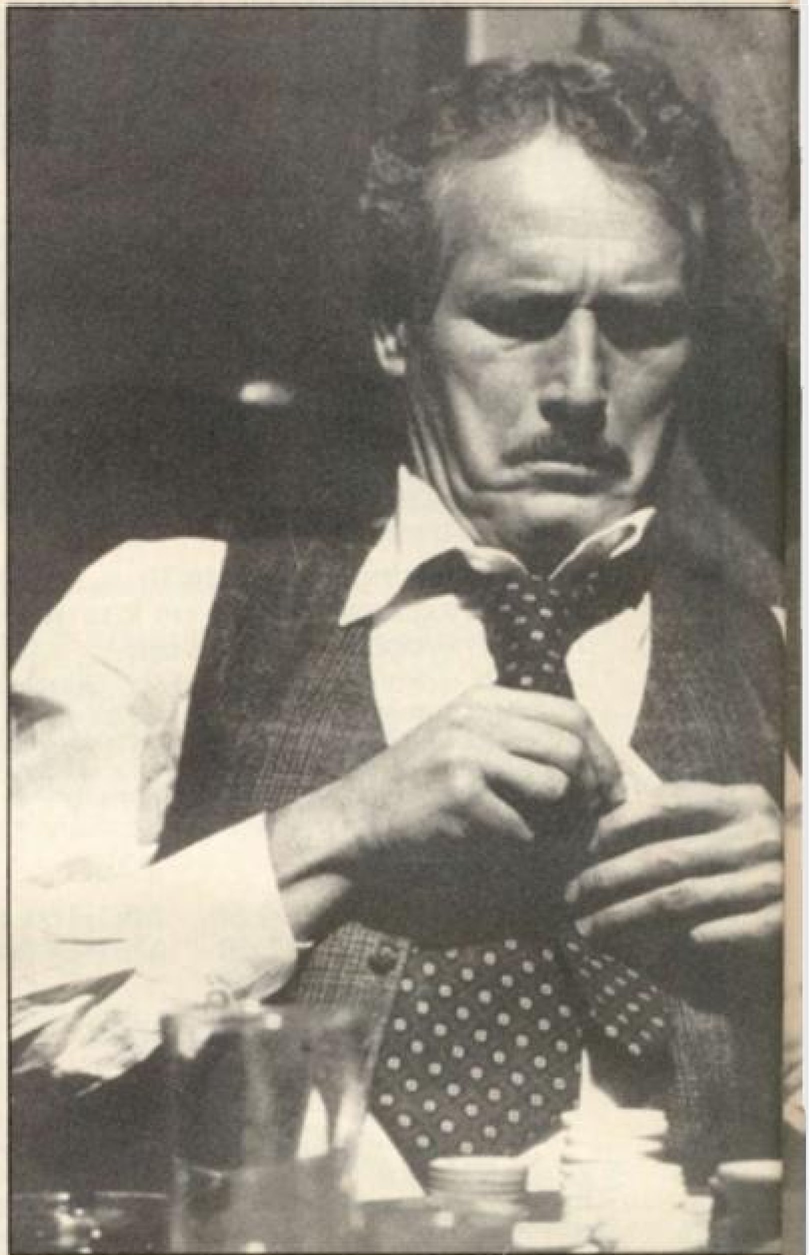
You should get the result one, because two does equal two, but if you try:

```
PRINT (3 = 4)
```

Then you will get zero, because three does not equal four.

I hope you are a little more enlightened.





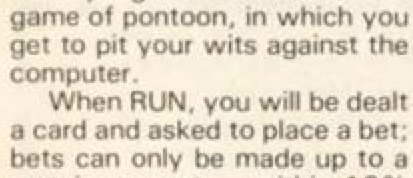
Photograph courtesy of Cinema International Corp. (UK).

Play your cards right

This program simulates the game of pontoon, in which you get to pit your wits against the computer.

When RUN, you will be dealt a card and asked to place a bet; bets can only be made up to a certain amount — within 10% of your credit. You will then be dealt another card and given the option to 'stick', 'twist' or 'buy'. This is done by pressing the appropriate key on the keyboard, ie the 's' key to stick, the 't' key to twist and the 'b' key to buy.

Your deal . . .



If you've never played pontoon before, here is a brief resumé. You are dealt a single card, and on that you have to work out how good your hand might be and place a suitable bet accordingly. You then receive your next card. The idea of the game is to make your cards up to a value of 21; Kings, Queens and Jacks are all worth 10 points each, and an Ace can be worth one or 11. With the two original cards you hold, you must decide either to 'stick' which means you pick up no more cards, 'twist' which means you receive another card (you can receive up to three more cards), or 'buy' which means you receive another card but you buy it from the dealer so that you effectively increase your bet.

The winner of a hand of pontoon is the one who gets their cards to total 21 or the nearest to 21. If you get five cards to total 21 or under, then this is known as a 'five card trick' and this hand beats all. Should the computer and your hand equal the same, it will depend on who is dealing as to who will win — in the game of pontoon, this is known as Banker's privilege.

Twist and shout

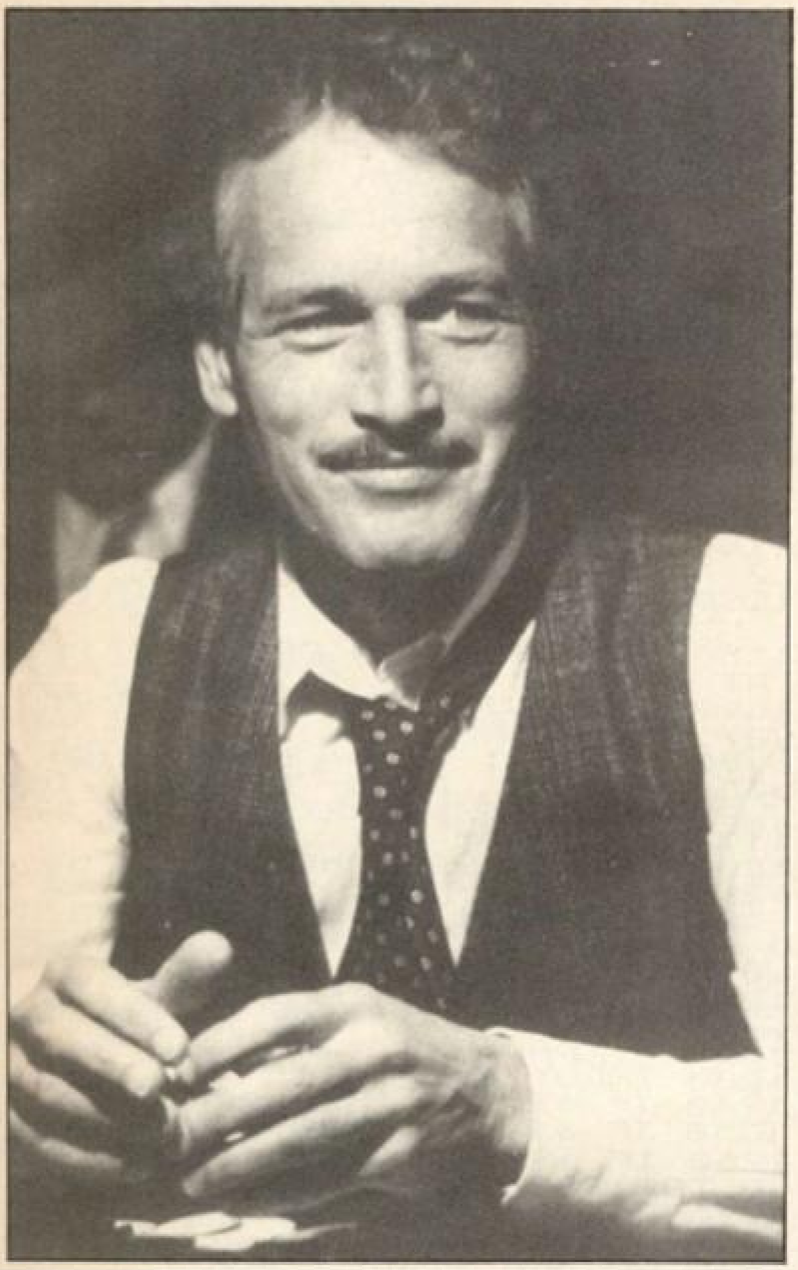
When you have settled on your final hand and pressed the 's' key to stick, then the computer deals its own hand, decides whether to stick or not and finally checks its hand against your own. The computer then either takes your bet if it has won or returns your original bet plus your winnings if you managed to have the winning hand.

One nice touch in the program is that the computer doesn't just keep dealing itself cards until it beats your own hand or 'goes bust' (which is pontoon-talk for holding cards which total more than 21) but actually makes a decision whether or not to draw another card. This decision is based on the value of the cards you have stuck on and the amount of cash you have placed as your bet. Only when the computer has stuck are the cards displayed and the winner announced.

Variations on a theme

Although there are copius REM statements throughout the program to help you follow its intricacies, here is a list of the variables used.

AMT — Amount of credit.
ITME — The Spectrum or player dealing.
ACEI — An ace has been dealt.
ME — Value of the player's final hand.
V — Current value of the cards.
T — Number of cards dealt.
ODDS — Calculation for the Spectrum to decide whether to stick or not.
Bet — Amount bet on the initial card.
Buy — Total amount for bought cards.
Stake — The stake for each game.
S$ — The suit of each card.
R$ — The Jack, Queen or King.



Play pontoon on your Spectrum with this game written for us by C Taft of Coventry.

```
  20 POKE 23609,30: GO TO 1850
  30 LET amt=500
  40 LET stake=10: DIM z$(1,8):
DIM s$(4): DIM c(52): DIM h(5,2)
: DIM t(4): LET s$(1)="H": LET s
$(2)="D": LET s$(3)="S": LET s$(
4)="C"
  50 LET itme=100: LET ace1=0: L
ET w=0: LET k=1: LET a=1: LET c=
0: LET me=0: LET v=0: LET buy=0:
 LET bet=0: LET amt=amt-stake: L
ET n=0
  60 FOR s=1 TO 4
  70 FOR r=2 TO 14
  80 LET n=n+1: LET c(n)=10*r+s
  90 NEXT r: NEXT s
 100 FOR n=1 TO 52
 110 BEEP .003,-n+52: LET m=INT
(RND*52)+1: LET t=c(m): LET c(m)
=c(n): LET c(n)=t
 120 BEEP .003,n: NEXT n
 130 LET n=0
 140 PAPER 4: BORDER 2: CLS
 150 FOR n=0 TO 8 STEP 4: PAPER
7: INK 2: PRINT AT 0,0+n;"H"; IN
K 0;"C"; INK 2;"D"; INK 0;"S";:
NEXT n
 160 PAPER 1: INK 7: PRINT "PONT
OON";
 170 FOR n=19 TO 27 STEP 4: PAPE
R 7: INK 2: PRINT AT 0,n;"H"; IN
K 0;"C"; INK 2;"D"; INK 0;"S";:
NEXT n: PRINT INK 2;"H"
 180 PAPER 7: INK 1: PRINT AT 2,
11;"Your hand";AT 15,2;"Your tot
al ";v;AT 15,19;"Credit £";amt
 190 GO SUB 580
 200 IF ace1=0 AND t>=2 THEN GO
TO 310
 210 GO TO 510: GO TO 470
 220 REM S T B
 230 PAPER 4: PRINT AT 18,0;"
     "; PAPER 7; INK 2;AT 18,7;"E
NTER "; INK 1;"Your choice"; PAP
ER 4;"
                "; PAPER 7;"s -
STICK,t - Twist.b -Buy."
 240 IF t=5 THEN LET me=21: GO T
O 1550
 250 INPUT a$
 260 IF a$<>"s" AND a$<>"t" AND
a$<>"b" THEN GO TO 250
 270 IF a$="s" THEN PAUSE 50: GO
TO 470
 280 IF a$="b" THEN GO TO 340
 290 REM T
 300 LET t=t+1: GO SUB 600
 310 REM I BUST
 320 IF v>21 THEN GO TO 410
 330 GO TO 220
 340 REM I BUY
 350 PAPER 7: INK 2: PRINT AT 18
,2;"ENTER"; INK 1;" Amount (Whol
e £'s)."
 360 PAPER 7: INK 2: PRINT AT 20
,2;"UPTO "; INK 2;" £";INT (((am
t-bet-buy)*.1)+.5); PAPER 4;"
                  "
 370 INPUT buy1
 380 IF buy1>INT ((amt-bet-buy)*
.1)+.5 THEN GO TO 370
 390 LET buy=buy+buy1
 400 PAUSE 50: GO TO 290
 410 REM I BUST
 420 PAUSE 20: FOR z=1 TO 40: BE
EP .05/(z/7),-z/7: FLASH 1: PRIN
T AT 13,6; PAPER 7; INK 2;"Sorry
 you have bust": NEXT z: FLASH 0
 430 PAPER 4: PRINT AT 13,6;"
          "
 440 LET amt=INT (amt-(buy+bet)+
.5)
 450 PAPER 7: INK 1: PRINT AT 15
,27;amt; PAPER 4;" "
 460 GO TO 50
 470 REM S
 480 IF v>=15 THEN LET me=v: GO
TO 860
 490 BEEP .5,-5: PAPER 3: INK 7:
 PRINT AT 13,0;"You cannot stick
 on less than 15": PAUSE 75
 500 PAPER 4: PRINT AT 13,0;"
                               ":
GO TO 220
 510 REM Bet
 520 PAPER 7: INK 2: PRINT AT 18
,2;"ENTER"; INK 1;" Your bet (Wh
ole £'s).";AT 20,2; INK 2;"UPTO
"; INK 1;" £";INT (amt*.1)+.5;
 530 PAPER 4: PRINT "
          "
 540 INPUT bet
 550 IF bet>INT (amt*.1)+.5 THEN
 GO TO 540
 560 IF ace1=1 THEN GO SUB 600:
```

```
GO TO 1720
 570 LET t=t+1: GO SUB 600: GO T
O 220
 580 REM PICK CARD
 590 LET t=1
 600 LET d=1: LET n=n+1: LET h(t
,d)=c(n)*10+t: LET temp=c(n): GO
 SUB 760
 610 PAUSE 70
 620 GO SUB 1780
 630 IF r$(1)="j" OR r$(1)="q" O
R r$(1)="k" THEN BEEP .1,r: GO T
O 650
 640 BEEP .1,r: GO SUB 1270+(r*2
0)
 650 IF r$(1)="j" THEN GO SUB 14
90
 660 IF r$(1)="q" THEN GO SUB 15
10
 670 IF r$(1)="k" THEN GO SUB 15
30
 680 IF itme=100 THEN INK 1: PRI
NT AT 15,13;v
 690 IF itme<>100 THEN PAPER 7:
INK 1: PRINT AT 15,2;"My total "
;v;AT 15,19;"Pay ";AT 19,2;"Amou
nt bet £";bet+buy;AT 19,19;"Cred
it £";amt
 700 IF itme<>100 AND v>=21 OR i
tme<>100 AND t=5 THEN GO TO 740
 710 IF itme<>100 AND v=20 THEN
PRINT v+1;AT 17,14;"Five card tr
icks"
 720 IF itme<>100 THEN PRINT AT
15,23;v+1
 730 IF itme<>100 THEN GO TO 750
 740 IF itme<>100 THEN PAPER 4:
PRINT AT 15,19;"    "
 750 RETURN
 760 LET r=INT (temp/10): LET s=
temp-r*10: LET r=r+1: LET r$=STR
$ r
 770 IF r=15 THEN LET r$="ACE"
 780 IF r=15 AND ace1=0 THEN GO
TO 1680
 790 IF r=15 AND ace1=1 THEN GO
SUB 600
 800 IF r=14 THEN LET r$(1)="k"
 810 IF r=13 THEN LET r$(1)="q"
 820 IF r=12 THEN LET r$(1)="j"
 830 IF r>=12 AND r<15 THEN LET
r=11
 840 LET r=r-1: LET v=v+r
 850 RETURN
 860 REM ZX deal
 870 CLS : PAPER 4
 880 FOR z=0 TO 8 STEP 4: PAPER
7: INK 2: PRINT AT 0,0+z;"H"; IN
K 0;"C"; INK 2;"D"; INK 0;"S";:
NEXT z
 890 PAPER 1: INK 7: PRINT "PONT
OON";
 900 FOR z=19 TO 27 STEP 4: PAPE
R 7: INK 2: PRINT AT 0,z;"H"; IN
K 0;"C"; INK 2;"D"; INK 0;"S";:
NEXT z
 910 PAPER 7: INK 2: PRINT AT 2,
12;"My hand"
 920 LET c=c+6: LET v=0: LET v1=
0: LET itme=0: LET t=0: LET a=1
 930 IF t=5 AND v<=21 THEN GO TO
 1030
 940 IF v<15 THEN GO TO 1000
 950 IF v=21 THEN GO TO 1030
 960 IF v>21 THEN GO TO 1100
 970 LET odds=INT ((v/((bet+buy)
(amt/5)))/50)+1
 980 IF odds<4 AND v>=17 THEN GO
 TO 1010
 990 IF odds>=4 THEN GO TO 1010
1000 LET t=t+1: GO SUB 600: GO T
O 930
1010 IF v>=me OR v=me+1 THEN GO
TO 1030
1020 IF v<me+1 THEN GO TO 1100
1030 REM I lose
1040 LET amt=INT (amt-(bet+buy)+
.5)
1050 PAPER 3: INK 7: PRINT AT 19
,2;"You've lost £";bet+buy
1060 PAPER 7: INK 1: PRINT AT 19
,27;amt; PAPER 4;"  "
1070 FOR x=20 TO -10 STEP -.7: B
EEP .01,x: NEXT x
1080 IF amt<20 THEN PAPER 7: INK
 2: FOR z=100 TO 50 STEP -1: BEE
P .01,z-75: FLASH 1: PRINT AT 13
,4;"Sorry no money left!!!!": NE
XT z: FLASH 0: GO TO 1220
1090 GO TO 50
1100 REM I WIN
1110 LET wl=bet+buy+stake
1120 LET amt=amt+wl
1130 LET amt=INT (amt+.5)
1140 PAPER 2: INK 7: PRINT AT 19
,2;"You've won £";bet+buy;
1150 PAPER 4: PRINT AT 15,19;"
  "
1160 IF v=20 THEN PAPER 4: PRINT
 AT 17,14;"                   "
1170 PAPER 7: INK 1: PRINT AT 19
,27;amt; PAPER 4;"  "
1180 FOR z=1 TO 4: BEEP .2,0: PA
USE 4: BEEP .2,-5: PAUSE 4: BEEP
 .2,5: PAUSE 4: NEXT z
1190 REM HIGH AMT
1200 IF amt<999 THEN GO TO 50
1210 PAPER 7: INK 2: FOR z=50 TO
 100: FLASH 1: PRINT AT 13,3;"Yo
u have broke the bank!!!": BEEP
.01,z-75: NEXT z: FLASH 0
1220 PAPER 4: PRINT AT 13,2;"
     "; PAPER 7; INK 2;"Another
game?"; PAPER 4;"        "
1230 INPUT a$
1240 IF a$="y" THEN GO TO 30
1250 IF a$="n" THEN STOP
1260 IF a$<>"y" OR a$<>"n" THEN
GO TO 1230
1270 REM Print cards
1280 REM 1
1290 GO SUB 1780
1300 PAPER 7: PRINT AT k+3,a;"A
    ";AT k+4,a;"     ";AT k+5,a;"
  ";AT k+6,a;"  ";CHR$ z;"  "
;AT k+7,a;"     ";AT k+8,a;"
  ";AT k+9,a;"     ": LET a=a+6:
RETURN

1310 REM 2
1320 PAPER 7: PRINT AT k+3,a;"2
    ";AT k+4,a;"  ";CHR$ z;"  ";A
T k+5,a;"     ";AT k+6,a;"
;AT k+7,a;"     ";AT k+8,a;"  ";
CHR$ z;"  ";AT k+9,a;"     ": LE
T a=a+6: RETURN
1330 REM 3
1340 PAPER 7: PRINT AT k+3,a;"3
    ";AT k+4,a;"  ";CHR$ z;"  ";A
T k+5,a;"     ";AT k+6,a;"  ";CH
R$ z;"  ";AT k+7,a;"     ";AT k+
8,a;"  ";CHR$ z;"  ";AT k+9,a;"
    ": LET a=a+6: RETURN
1350 REM 4
1360 PAPER 7: PRINT AT k+3,a;"4
    ";AT k+4,a;" ";CHR$ z;" ";CHR
$ z;" ";AT k+5,a;"     ";AT k+6,
a;"     ";AT k+7,a;"     ";AT k+
8,a;" ";CHR$ z;" ";CHR$ z;" ";AT
 k+9,a;"     ": LET a=a+6: RETUR
N
1370 REM 5
1380 PAPER 7: PRINT AT k+3,a;"5
    ";AT k+4,a;" ";CHR$ z;" ";CHR
$ z;" ";AT k+5,a;"     ";AT k+6,
a;"  ";CHR$ z;"  ";AT k+7,a;"
  ";AT k+8,a;" ";CHR$ z;" ";CHR$
 z;" ";AT k+9,a;"     ": LET a=a
```



```
+6: RETURN
1390 REM 6
1400 PAPER 7: PRINT AT k+3,a;"6
  ";AT k+4,a;" ";CHR$ z;" ";CHR
$ z;" ";AT k+5,a;"    ";AT k+6,
a;" ";CHR$ z;" ";CHR$ z;" ";AT k
+7,a;"     ";AT k+8,a;" ";CHR$ z
;" ";CHR$ z;" ";AT k+9,a;"     "
: LET a=a+6: RETURN
1410 REM 7
1420 PAPER 7: PRINT AT k+3,a;"7
  ";AT k+4,a;" ";CHR$ z;" ";CHR
$ z;" ";AT k+5,a;"  ";CHR$ z;"
";AT k+6,a;" ";CHR$ z;" ";CHR$ z
;" ";AT k+7,a;"     ";AT k+8,a;"
 ";CHR$ z;" ";CHR$ z;" ";AT k+9,
a;"     ": LET a=a+6: RETURN
1430 REM 8
1440 PAPER 7: PRINT AT k+3,a;"8
  ";AT k+4,a;" ";CHR$ z;" ";CHR
$ z;" ";AT k+5,a;"  ";CHR$ z;"
";AT k+6,a;" ";CHR$ z;" ";CHR$ z
;" ";AT k+7,a;"  ";CHR$ z;"  ";A
T k+8,a;" ";CHR$ z;" ";CHR$ z;"
";AT k+9,a;"     ": LET a=a+6: R
ETURN
1450 REM 9
1460 PAPER 7: PRINT AT k+3,a;"9
  ";AT K+4,a;" ";CHR$ z;" ";CHR
$ z;" ";AT k+5,a;" ";CHR$ z;" ";
CHR$ z;" ";AT K+6,a;"  ";CHR$ z;
"  ";AT k+7,a;" ";CHR$ z;" ";CHR
$ z;" ";AT K+8,a;" ";CHR$ z;" ";
CHR$ z;" ";AT k+9,a;"     ": LET
 a=a+6: RETURN
1470 REM 10
1480 PAPER 7: PRINT AT k+3,a;"T
  ";AT K+4,a;" ";CHR$ z;CHR$ z;
CHR$ z;" ";AT K+5,a;"  ";CHR$ z;
"  ";AT k+6,a;" ";CHR$ z;" ";CHR
$ z;" ";AT K+7,a;"  ";CHR$ z;"
";AT K+8,a;" ";CHR$ z;CHR$ z;CHR
$ z;" ";AT K+9,a;"     ": LET a=
a+6: RETURN
1490 REM J
1500 PAPER 7: PRINT AT k+3,a;"J
  ";AT k+4,a;" ";CHR$ z;CHR$ z;
CHR$ z;" ";AT k+5,a;" ABE ";AT k
+6,a;" IJK ";AT k+7,a;" LMN ";AT
 k+8,a;" ";CHR$ z;CHR$ z;CHR$ z;
" ";AT k+9,a;"     ": LET a=a+6:
 RETURN
1510 REM Q
1520 PAPER 7: PRINT AT k+3,a;"Q
  ";AT k+4,a;" ";CHR$ z;CHR$ z;
CHR$ z;" ";AT k+5,a;" FGO ";AT k
+6,a;" IJK ";AT k+7,a;" LMN ";AT
 k+8,a;" ";CHR$ z;CHR$ z;CHR$ z;
" ";AT k+9,a;"     ": LET a=a+6:
 RETURN
1530 REM K
1540 PAPER 7: PRINT AT k+3,a;"K
  ";AT k+4,a;" ";CHR$ z;CHR$ z;
CHR$ z;" ";AT k+5,a;" PQR ";AT k
+6,a;" IJK ";AT k+7,a;" LMN ";AT
 k+8,a;" ";CHR$ z;CHR$ z;CHR$ z;
" ";AT k+9,a;"     ": LET a=a+6:
 RETURN
1550 REM 5CT
1560 PAPER 7: INK 2: FOR z=50 TO
 100: FLASH 1: BEEP 1/z,z-75: PR
INT AT 13,7;"Five card trick": N
EXT z: FLASH 0
1570 PAPER 4: PRINT AT 13,7;"
          ": GO TO 860
1580 REM ZX 11/1 ?
1590 PAUSE 70
1600 IF t=1 THEN LET r=11: GO TO
 1650
1610 IF t=4 OR v<7 THEN LET r=1:
 GO TO 1650
1620 IF t=2 AND v<=10 AND v>=7 O
R t=3 AND v<=10 AND v>=7 OR t=4
AND v<=10 AND v>=7 THEN LET r=11
: GO TO 1650
1640 LET r=1
1650 LET v=v+r
1660 GO SUB 1780
1670 BEEP .1,r: GO SUB 1290: GO
SUB 680: GO TO 930
1680 REM ZX/ME?
1690 REM ME ACE 1/11
1700 IF itme=0 THEN GO TO 1580
1710 IF r$(1)="A" AND t=1 THEN L
ET r=0: GO SUB 1290: LET ace1=1:
 GO TO 510
1720 PAPER 7: INK 2: PRINT AT 18
,0;"Ace dealt do you want 1 or 1
1?"; PAPER 4;"     "
1730 INPUT r
1740 IF ace1=1 THEN LET v=v+r: G
O SUB 680
1750 IF ace1=1 THEN LET ace1=0:
GO TO 220
1760 IF ace1=0 THEN BEEP .1,r: G
O SUB 1290
1770 LET v=v+r: GO SUB 680: GO T
O 200
1780 REM SUIT COLOUR
1790 IF s$(s)="H" THEN LET z=151
: INK 2
1800 IF s$(s)="C" THEN LET z=146
: INK 0
1810 IF s$(s)="D" THEN LET z=147
: INK 2
1820 IF s$(s)="S" THEN LET z=162
: INK 0
1830 RETURN
1840 REM GRAPHICS
1850 RESTORE : FOR n=1 TO 20: RE
AD p$
1860 FOR f=0 TO 7
1870 READ a: POKE USR p$+f,a
1880 NEXT f
1890 NEXT n
1900 DATA "h",0,0,54,62,28,8,0,0
1910 DATA "d",0,0,8,28,62,28,8,0
1920 DATA "c",0,0,28,42,62,42,8,
0
1930 DATA "s",0,0,8,28,62,54,8,0
1940 DATA "t",0,94,82,82,82,82,9
4,0
1950 DATA "a",0,0,243,121,63,31,
15,7
1960 DATA "b",0,0,231,231,255,25
5,255,255
1970 DATA "e",0,0,207,158,252,24
8,240,244
1980 DATA "i",4,12,14,16,32,64,6
4,56
1990 DATA "j",84,85,42,21,10,10,
10,5
2000 DATA "k",160,80,144,88,164,
172,162,86
2010 DATA "l",8,4,24,16,16,15,1,
2
2020 DATA "m",5,5,5,29,98,191,0,
0
2030 DATA "n",82,86,82,82,212,88
,232,4
2040 DATA "f",0,0,240,121,63,31,
15,7
2050 DATA "g",0,0,195,231,255,60
,255,255
2060 DATA "o",0,0,15,158,252,248
,240,224
2070 DATA "p",0,0,255,121,48,16,
9,7
2080 DATA "q",0,0,255,231,195,19
5,231,25
2090 DATA "r",0,0,255,158,12,8,1
44,224
2100 GO TO 30
2110 SAVE "pontoon" LINE 1
```

The 1K corral

What can you do with an unexpanded ZX81? The possiblities are endless as you'll soon find out . . .



In this new regular feature, we'll be including a galaxy of games and useful routines for you to type into your 1K ZX81.

Although sometimes frustrating to work within such a limited amount of memory, you may find it a worthwhile exercise to study how programmers have managed to use the memory space — something you may (and should) find useful even when working within 16K or 48K.

If you would like to contribute material to this feature, please try to explain the techniques you have employed to get your program into 1K.

But enough of the introduction, get typing and have fun.

Star swerver
Paul Smith

When you first play this game you must input your highest score. The computer then draws a star galaxy through which your ship ('< ') must avoid.

As the game progresses and several crossings have been made across the screen, you will find the number of stars increases. In fact, the games gets very hard when the score goes over 400 — but

if you manage to get that far, you'll no doubt be good enough to cope.

At the end of the game, your score and the highest score are shown; there is also an option inviting you to have another game.

As a brief note on the graphics, the following are on these lines:

Line 35 includes a Graphic shifted 2.
Line 90 includes a Graphic shifted 1.
Line 100 includes a Graphic shifted 1.
Line 200 includes a Graphic shifted 1.
Line 360 includes a Graphic shifted 2.



```
1   INPUT H
2   LET S=CODE " "
9   CLS
35  FOR A=CODE " " TO CODE "1" + (CODE " ■"
    * (S/CODE "1"))
40  PRINT AT RND * CODE ":', RND * CODE
    "/";" * "
50  NEXT A
70  LET P=INT(RND * CODE ":")
80  FOR A=CODE "1" TO CODE " " STEP - CODE
    " ";
90  PRINT AT P,A; " "; AT P,A - CODE "■    ";
92  IF PEEK (PEEK 16398 + 256 * PEEK
    16399)=CODE " * " THEN GOTO CODE "COS"
94  PRINT AT P,A; ""
95  LET P=P+(INKEY$="6" AND P CODE ":") -
    (INKEY$="7")
100 LET S=S + CODE "■     "
120 NEXT A
160 GOTO CODE "▨▨"
200 PRINT AT P,A - CODE "■ ";" > X < "
300 IF H< S THEN LET H=S
350 PRINT AT CODE " "; CODE " "; "SCORE = ":S,,
    "HIGHEST = ";H,," AGAIN? (Y/N)"
360 GOTO (VAL "360" AND INKEY$=" ") + (CODE
    " ■" AND INKEY$="Y")
```

Lucky dice
Colin James

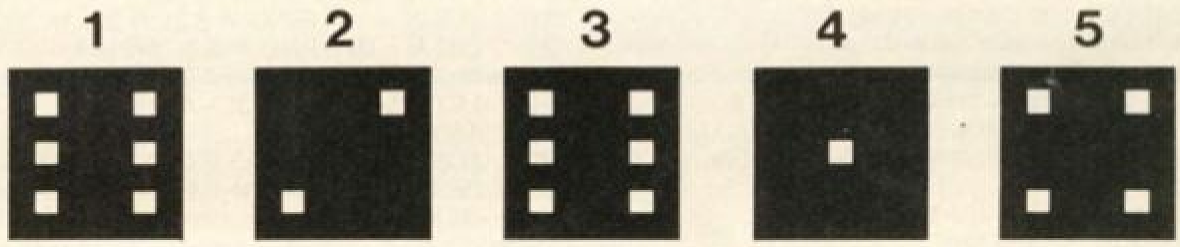
This program 'throws' five numbered dice on the screen and then allows you to re-throw from none to all of them again twice. In this way you could quite successfully play a game of Poker Dice with a friend on your ZX81.

After RUNning the program, five dice are displayed on the screen and you have to choose which dice you require to change, if any. You enter the numbers of the dice you want to change as a string and then press Newline. For instance, if the display is as in Fig. 1 and you wish to change the '2', '1' and '4' (the second, fourth and fifth dice) you would press the '2', '4' and '5' keys followed by Newline.

When your turn is over, a reminder message is displayed and pressing any key will re-throw all five dice for another turn. If you decide after your first or second throw that you wish to stick on your dice score, pressing Newline will finish your turn.

I put the subroutine at line 3 to allow GOSUB PI to be used as a memory saver. When I first started the program, I had line 10 as four quite long IF . . . THEN statements which caused the program to run out of memory. Using the subroutine at line 3 I managed to save enough memory to allow it to fit relatively easily into 1K.

Fig. 1.




```
1   GOTO EXP PI
3   LET T=N*5
4   PRINT AT 7,T-I;N
5   PRINT AT 9,T-PI; "       "
6   FOR S=I TO PI
7   PRINT AT 9+S, T-PI; "        "
8   NEXT S
9   LET S=INT(RND*6+1)
10  PRINT AT 11,T-I; "  " AND S-2
    *INT (S/2);AT 10,T; "  " AND S>I AT 12, T-2; "
    " AND S>I; AT 10, T-2;"  " AND S>PI; AT 12, T;
    "  " AND S>PI; AT 11, T-2; "   " AND S=6
20  RETURN
30  RAND
40  LET I=SGN PI
50  FOR N=I TO 5
60  GOSUB PI
70  NEXT N
80  FOR F=SIN PI TO I
90  INPUT R$
100 IF R$="" THEN GOTO 160
110 FOR V=I TO LEN R$
120 LET N=VAL R$(V)
130 GOSUB PI
140 NEXT V
150 NEXT F
160 PRINT AT 15, PI; "END OF YOUR GO"
170 PAUSE 4E4
180 CLS
190 RUN
```

Catch a star
Jan Van den Broeck

I have been experimenting with INKEY$ and worked out a small program for the 1K ZX81. It even has a cheat routine.

You have to try and catch a falling star (' * ') in a black box ('■ '). To move the box, you must use the '5' and '8' keys to move left and right respectively. After ten turns, the score is displayed on the screen.

When you have RUN the program, it'll wait for you to press any key. However, if you press the 'L' key the program switches over to auto-pilot so you can see what the game is all about.

```
1   RAND 0
3   IF INKEY$ ="" THEN GOTO 3
5   LET A$ = INKEY$
10  LET A = VAL "10"
20  LET SCORE = PI-PI
30  FOR L = 1 TO A
40  LET X = INT (RND * 12)+1
50  FOR Y = 0 to 21
60  PRINT AT Y,X; " * "
70  IF A$ = "L" THEN GOSUB 200
75  LET A = A+(INKEY$ = "8")-(INKEY$ = "5")
80  PRINT AT 21, A; " ■ "
90  IF X = A+1 AND Y=21 THEN LET SCORE =
    SCORE +1
100 PRINT AT Y,X; "  "
110 NEXT Y
120 NEXT L
150 PRINT AT 10,10; "SCORE"; SCORE
160 STOP
200 IF (A+1)<X THEN LET A=A+1
220 IF (A+1)>X THEN LET A=A-1
230 RETURN
```

Shuffler
Derek Sorensen

This program simulates the shuffling of a standard pack of cards and then deals the pack out one after another.

Line 10 sets up the string variable A$ for use as a data file, in this case representing a pack of 52 cards. Lines 20 to 60 'shuffle' the pack, repeating the process 'N' times, using a FOR . . . NEXT N loop. We now have the pack of cards in its shuffled form.

Lines 70 to 90 then print out the shuffled pack, this time using a FOR . . . NEXT M loop.

```
10  LET A$="AH2H3H4H5H6H7H8H9HTHJHQHKH
    AC2C3C4C5C6C7C8C9CTCJCQCKCAD2D3D4D
    5D6D7D8D9DTDJDQDKDAS2S3S4S5S6S7S8S9S
    TSJSQSKS"
20  FOR N= 1 TO 100
30  LET X= INT(RND * 52) * 2+1
35  LET Y=INT(RND * 52) * 2+1
40  IF X>=Y THEN NEXT N
50  LET A$=A$(Y TO)+A$(X TO Y-1)+A$(TO X-1)
60  NEXT N
70  FOR M=1 TO 103 STEP 2
80  PRINT A$(M TO M+1); " ";
90  NEXT M
```

Electronic fence
Robert Saundby

This program is a game in which you have to move a '+' sign round the screen using the cursor keys to draw an electronic fence around the inverse speech marks which are the 'bugs' you have to catch. These bugs appear whenever the moving Queen bug lays an egg which, of course, immediately hatches into a baby bug.

If the plus sign goes into a bug then you are bitten to death, but if the Queen bug (represented by a Graphic A) walks into the fence then she dies and you have won the game.

After the game, pressing any key clears the screen and the game starts again. Watch out for the Queen bug as she will move about the screen at random and occasionally jumps to another part of the screen.

```
1   LET X = VAL "9"
2   LET Y = VAL "12"
3   LET A = (RND * 9) +5
4   LET B = (RND * 8) +4
5   PRINT AT X,Y; "(inverse plus sign)"; AT A,B;
    "(graphic A)"; AT X,Y; "+"
6   LET X = X + (INKEY$ = "6")-(INKEY$ = "7")
7   LET Y = Y + (INKEY$ = "8")-(INKEY$ = "5")
8   PRINT AT X,Y;
9   IF PEEK (PEEK 16398 + 256 * PEEK 16399) =
    CODE "(inverse speech mark)" THEN GOTO 45
10  PRINT AT A,B; "(inverse speech mark)"
15  LET A=A + (RND * 3)- 1.5
20  LET B=B + (RND * 3)- 1.5
25  IF RND > .9 THEN GOTO 3
30  PRINT AT A,B;
35  IF PEEK (PEEK 16398 + 256 * PEEK 16399) =
    CODE "+" THEN GOTO 55
40  GOTO 5
45  PRINT AT 4,2; "YOU ARE BITTEN BY A ""BUG"" "
50  GOTO 75
55  FOR N=128 TO 182
60  PRINT A,B; CHR$ N
65  NEXT N
70  PRINT "THE QUEEN BUG IS ELECTROCUTED."
75  PAUSE 4E4
80  CLEAR
85  CLS
90  RUN
```



Manoeuvres
David Glover

This is a 1K version of the old schooldays game 'Battleships'.

Player one inputs a string (unseen by player two) for a pre-agreed number of ships and/or submarines. For example, if the agreed forces are two submarines (S), two cruisers (C) occupying two squares each and one battleship (B) occupying three squares, then player one inputs 'S1AS9HC4BC5BC7CC7DB2EB2FB2G' to place two submarines, one at 1A and one at 9H; two cruisers, one at 4B-5B and one at 7C-7D; and one battleship at 2E-2G.

The second player tries to locate the position of the ships by inputting something like '1B'. If the shot misses a '+' is shown at the relevant position. If the player scores a hit the letter 'S', 'C' or 'B' (or any other letters agreed by the players) is shown. Grid references must be shown number first, letter second.

The program is entered first followed by the variables as direct commands without line numbers. Begin by GOTO 15. Do not use RUN.

Variables

```
LET A = 1
LET B = 2
LET C = 3
LET D = 4
LET E = 5
LET F = 6
LET G = 7
LET H = 9
LET I = 10
LET J = 20
LET K = J+G
LET L = H+K
```

```
1   SAVE "B"
14  CLS
15  PRINT " ABCDEFGHI"
16  FOR Z = A TO H
17  PRINT AT Z,A;Z
18  NEXT Z
22  DIM A$(K)
25  INPUT A$(A TO K)
30  INPUT B$
35  IF B$ = "Z" THEN GOTO I+D
40  LET X = VAL B$(A)
50  LET Y = CODE B$(B)
60  PRINT AT X,Y-L;"+"
70  IF X = VAL A$(B) AND Y = CODE A$(C) THEN
    PRINT AT X,Y-L;A$(A)
80  IF X = VAL A$(E) AND Y = CODE A$(F) THEN
    PRINT AT X,Y-L;A$(D)
90  IF X = VAL A$(C+E) AND Y = CODE A$(H) THEN
    PRINT AT X,Y-L;A$(G)
100 IF X = VAL A$(I+A) AND Y = CODE A$(I+B) THEN
    PRINT AT X,Y-L:A$(I)
110 IF X = VAL A$(I+D) AND Y = CODE A$(I+E) THEN
    PRINT AT X,Y-L;A$(I+C)
120 IF X = VAL A$(I+G) AND Y = CODE A$(C*F)
    THEN PRINT AT X,Y-L;A$(I+F)
130 IF X = VAL A$(J) AND Y = CODE A$(J+A) THEN
    PRINT AT X,Y-L;A$(H+I)
140 IF X = VAL A$(J+C) AND Y = CODE A$(J+D)
    THEN PRINT AT X,Y-L;A$(J+B)
150 IF X = VAL A$(J+F) AND Y = CODE A$(K) THEN
    PRINT AT X,Y-L;A$(J+E)
200 GOTO J+I
```

Soccboss
Graham Mitchell

Soccboss is a simulation of managing a football club for the 1K ZX81. It features transfer markets, team strengths, money problems and as in real life, the ever present threat of being given the sack! Should you make it through a season, you will be awarded a rating and the possibility of continuing with your present team.

Inputing the program consists of two stages.

i) Enter the following as direct commands:

```
LET  A=1, LET B=2, LET C=3, LET D=4, LET E=5,
     LET F=10, LET G=0,
DIM  A$(5,6), LET A$(1)= " WOLVES ",
LET  A$(2)=" Q.P.R. ", LET A$(3)=" VILLA ",
LET  A$(4)=" LEEDS ", LET A$(5)=" SPURS ",
```

ii) The listing:
(Note all items underlined are inverse characters.)

```
3   LET T= E+F+INT(RND*C*F)
6   LET M=F*F+INT(RND*C*F)
10  LET P=G
13  FOR I=A TO F
16  PRINT " UNITED TS ";
    T;" £ ";M;" PL";I-A;" PTS ";P,"BUY/SELL?"
20  INPUT Z$
23  IF Z$="B" OR Z$="S" THEN GOTO F*F
30  PRINT "UNITED V ";A$(I/B)
33  LET Q=INT(T/F-C+RND*D)
36  IF Q<G THEN LET Q=G
40  LET R=INT(RND*E)
43  PRINT TAB B;Q;TAB F+A;R
46  LET P=P+C*(Q>R)+(Q=R)
50  LET M=M+B*F
    *(Q>R)+C*C*(Q=R)-INT(T/C)
53  FOR K=A TO F*F
54  NEXT K
56  CLS
60  NEXT I
63  PRINT " UNITED TS ";T;" £ ";M;" PL 10 PTS ";P
66  IF P>F+F THEN PRINT " CHAMPIONS "
70  PRINT " RATING ";INT(F*P+M/D+T*C)
73  IF P<F THEN GOTO F*C*D
76  STOP
100 PRINT "FEE?"
103 INPUT Z
106 IF Z$="S" THEN LET Z=-Z
110 LET T=T+INT(Z/F/(RND+C/B))
113 LET M=M-Z
116 IF T≥A AND M≥ -F*F THEN GOTO C*F
120 PRINT " SACKED "
```

On completion of input enter GOTO 1 to start. Your current status will be displayed together with a prompt to either buy or sell.

The status listing reads across as follows, your team's name 'United', their team strength (TS), how much cash is in the bank (£) (an overdraft facility is available to buy players with (all sums in £000s)), and how many games have been played (PL). There are ten games in a season and how many points have been gained is displayed; three points are awarded for a win, one for a draw.

To buy a player(s) enter 'B', to sell a player(s) enter 'S'; if you do not wish to enter the transfer market enter any other letter such as 'N'. If 'B' or 'S' is input another prompt 'Fee?' will occur — enter the amount of money you wish to buy or sell our player(s) for. But remember your overdraft limit!

The program then gives the result of your match played and loops back to the status listing and buy/sell prompt until the season is complete. Depending on your performance you will either be hailed as champions or sacked! Finishing the season is not automatic, gross incompetance is awarded by a swift termination of contract.

A new season keeping the same team variables can be obtained by entering GOTO 10.

Printman
Justin Perry

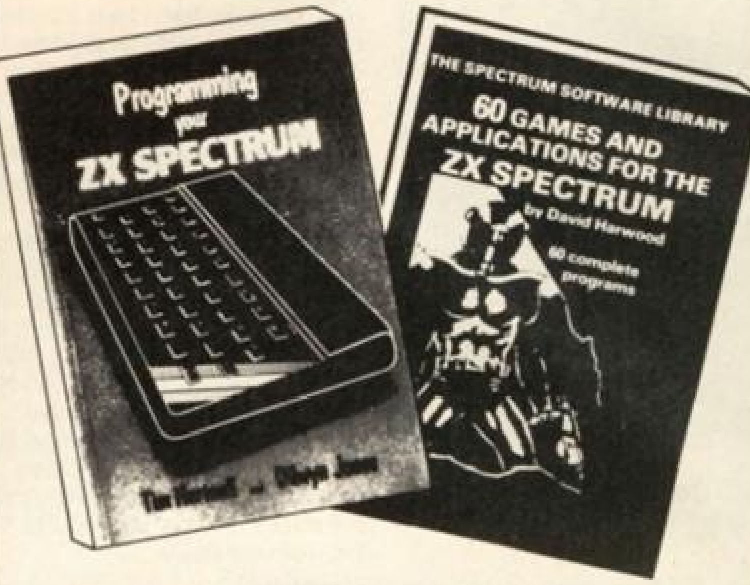
The outline of this arcade-type game is that you are the person in charge of the letter store. When the printing press wants some letters, they send a requisition down to you. Letters always come to you in batches of six. Unfortunately, you only see the letters for two seconds, so you have to remember them. Your choice of letters are shown at the very top of the screen and you are the letter 'O' flashing under them. The wanted letters appear at the bottom under the black line and stay there for two seconds after which they disappear. You must remember which letters were there and in what sequence they were in.

Then, controlling your movement left and right with keys '5' and '8' respectively, you must manoeuvre yourself under the appropriate letter, pressing the 'Y' key to get your answer registered. You are allowed to have only five wrong inputs after which you are sacked. All letter inputs *must* be in the sequence shown for the two seconds at the bottom or it will be rejected and you will lose one of your chances. An incorrect letter input leads to a 'w' being displayed at the bottom. Also displayed are your current score and the high score of the game so far. The scores for a correct letter are graduated from lowest to highest, from left to right at the top.

The difficulty can be varied in two ways. The first is by altering the amount of times you can get your input wrong before stopping the game. This is done by changing the value TI (a variable). To make this program harder, change the value in line 1020 to a smaller figure so that you are allowed less wrong goes. To make it easier do *vice versa*.

The other way is to make the time longer that you see your letters. To do this, change the second value to either a larger value for an easier game or a smaller value for a harder game. At this level, my highest score is 40,850.

```
1    REM "PRINTMAN"
2    LET S = 0
3    LET HS = 0
4    LET TI = 0
10   FOR F = 0 TO 25
20   PRINT AT 0, F;CHR$ (38+F); AT 15, F;CHR$ 3
30   NEXT F
35   DIM A$ (6)
40   FOR F = 1 TO 6
50   LET A$(F)=CHR$ (INT(RND * 26)+38)
60   NEXT F
70   PRINT AT 20, 20;A$
80   FOR F = 1 TO 100
90   NEXT F
100  PRINT AT 20, 20 ;"           "
110  LET A=1
120  LET B=15
130  PRINT AT A , B;"O"; AT A , B;"_"
140  LET B=B + (INKEY$ = "8" AND B<=29) -
     (INKEY$ = "5" AND B>=0)
150  IF INKEY$ = "Y" THEN GOSUB 9E2
160  IF A=7 THEN GOTO 35
170  GOTO 130
900  LET Z=B+38
910  IF A$ (A)<>CHR$ Z THEN GOTO 1E3
915  PRINT TAB 27; A$(A)
920  LET S= S+(B * 38)
930  PRINT AT 20 , 0;S; TAB 15 ; HS
940  LET A= A+1
950  RETURN
1000 PRINT AT 21 , TI;"W";
1010 LET TI= TI+1
1015 IF S>HS THEN LET HS=S
1020 IF TI<=5 THEN GOTO 130
1025 PRINT "SACKED";
1030 LET S=0
1040 LET TI=0
1400 CLS
1410 GOTO 10
```

It's action stations all the way in Stephen Smith's program for your 16K ZX81.

The object of this game is to shoot down the enemy reconnaissance aircraft before they can relay your secrets back to their headquarters. The program requires 8K as it stands, but the PRINT statements after line 650 could easily be shortened to allow for a smaller memory capacity.

In the air tonight

Displayed on your control panel are the bearing (of the enemy from you), the distance (between you and the enemy), the air speed, the heading (degrees from 0° North), altitude (in metres above the ground), the flaps (which alter the heading of your 'plane) and the artificial horizon (which alters the altitude).

When the flaps are set, up to a maximum of ±3, they will continue to change the heading until reset at zero. Likewise, the artificial horizon (A/H) will continue to change the altitude until reset at the centre.

The first thing to master is the take-off — you need to get your speed to around 70mph, but if you go too fast before attempting to take off (arrow keys '⇑' and '⇓' will change your artificial horizon) you will inevitably crash into the control towers at the end of the runway! If this happens, the radio crackles and messages appear on the screen (this is my favourite routine — see lines 700 to 800).

Once the enemy is within distance 20 and bearing 10, the enemy aircraft will appear in your 'plane's window provided the craft is at your altitude or up to 10m higher. Your firing range is within a distance of 10.

In control?

The controls you have at your disposal in your 'plane are:

- F — Fire.
- 2 — Slow down.
- 3 — Slow down fast.
- 9 — Speed up.
- 0 — Speed up fast.
- 6 — Decrease artificial horizon.
- 7 — Increase artificial horizon.
- 5 — Decrease flaps.
- 8 — Increase flaps.

The '5', '6', '7' and '8' keys correspond to the arrow keys. The important variables in the program are:

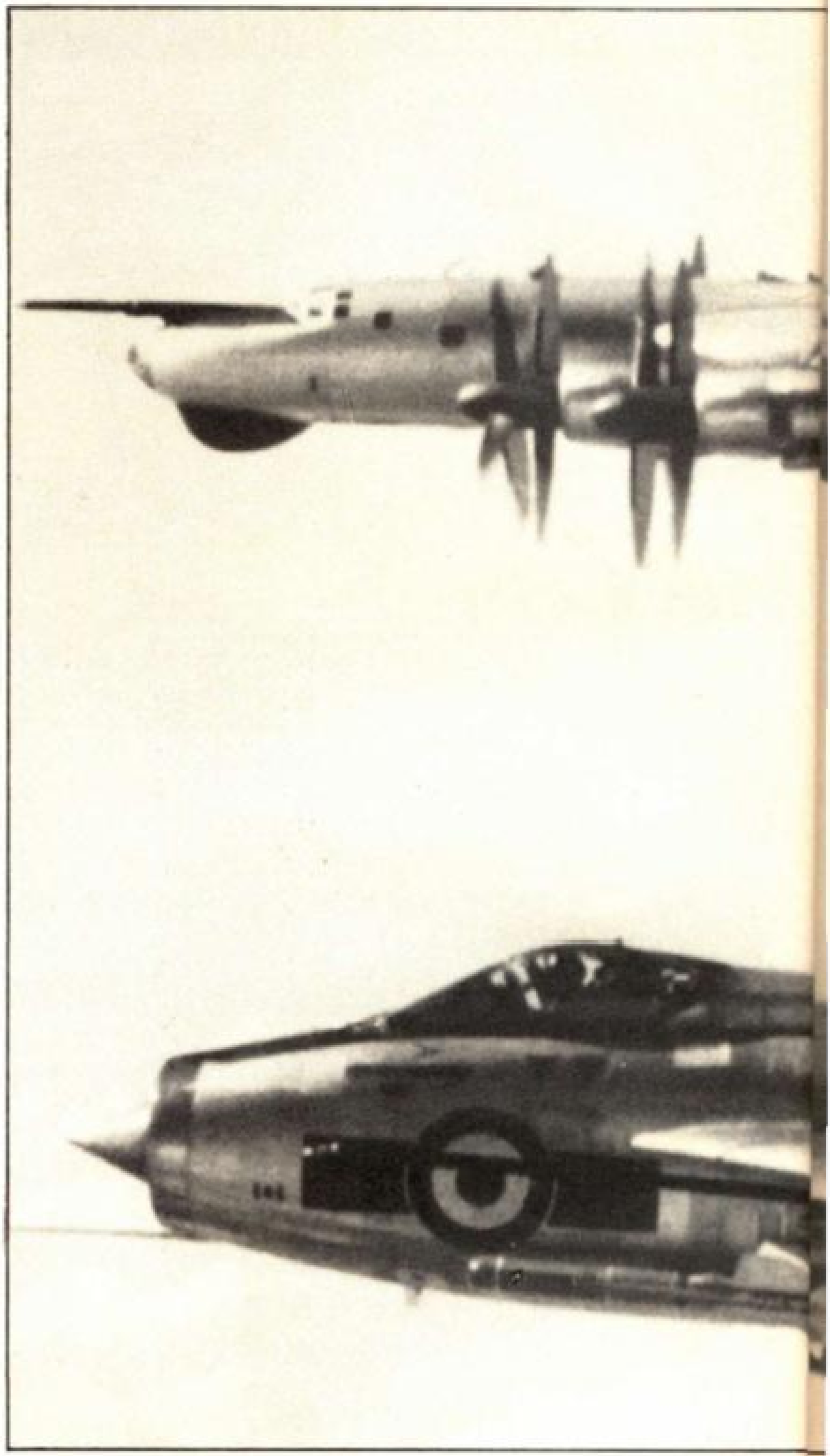
- ES — Enemy speed.
- S — The speed of your 'plane.
- H — The heading of your 'plane.
- EA — Enemy altitude.
- A — The altitude of your 'plane.
- F — Flaps.
- AH — Artificial horizon.
- AM — Ammunition left.
- D — Distance.
- B — Bearing.
- X — Your x-axis value.
- Y — Your y-axis value.

These last two values are taken from the position of the enemy craft — your opponent is always at position (0,0) heading along the y-axis.

Down the line

Here is a breakdown of some of the more important lines in the program:

48-100	Assign the 'calculating' variables.
110-220	Print the control panel.
230-285	Assign the 'displayed' variables.
300-490	The main program loop.
390	The heading conversion from plot to degrees.
400-460	Calculate the new co-ordinates, bearing and distance.
500	The routine for speed change.
535	The routine for artificial horizon change.
540	The routine for changing the flaps.
600	The fire routine.
700	The routine controlling a crash into the end of the runway.
800	The routine for no enemy 'planes left.
850	The routine for when your altitude is less than zero.
900	Loading routine.



```
  20 SLOW
  25 GOTO 40
  30 SAVE "RECONNAISSANCE ALERT"
  40 RAND
  42 PRINT "YOUR CONTROLS ARE:",
 "F FIRE",,,,"2 SLOW DOWN",,"3
SLOW DOWN FAST","9 SPEED UP",,"0
 SPEED UP QUICKLY",,," USE THE A
RROWS FOR DIRECTION","PRESS ANY
KEY..."
  45 IF INKEY$="" THEN GOTO 45
  48 LET PLANES=1
  55 LET ES=RND*1.67+1.67
  60 LET X=RND*10-5
  70 LET Y=RND*10-15
  80 LET H=RND*30-15
  90 LET Z=H*PI/15
 100 LET EA=5*INT (RND*16)+20
 110 CLS
 115 LET A$="
"
 120 PRINT "
       BEARING
DIST       ";A$
 150 PRINT "
```

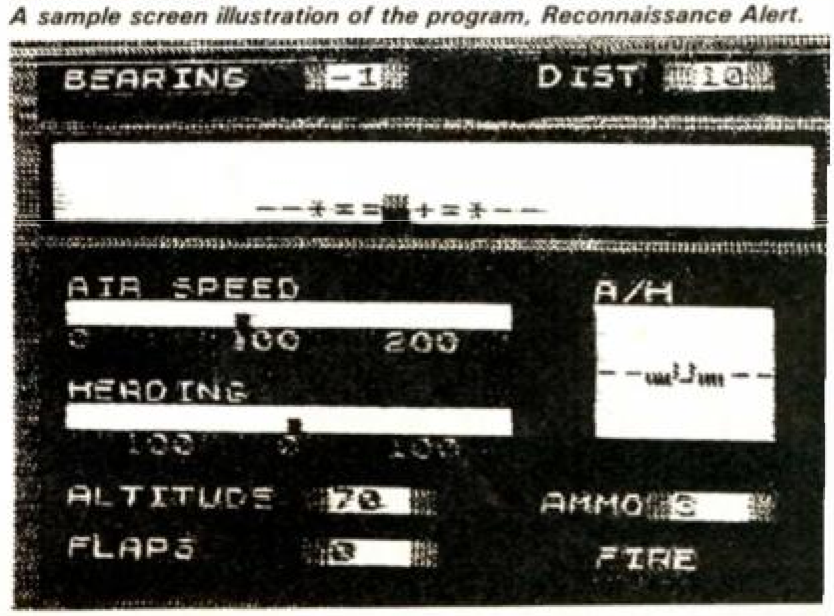


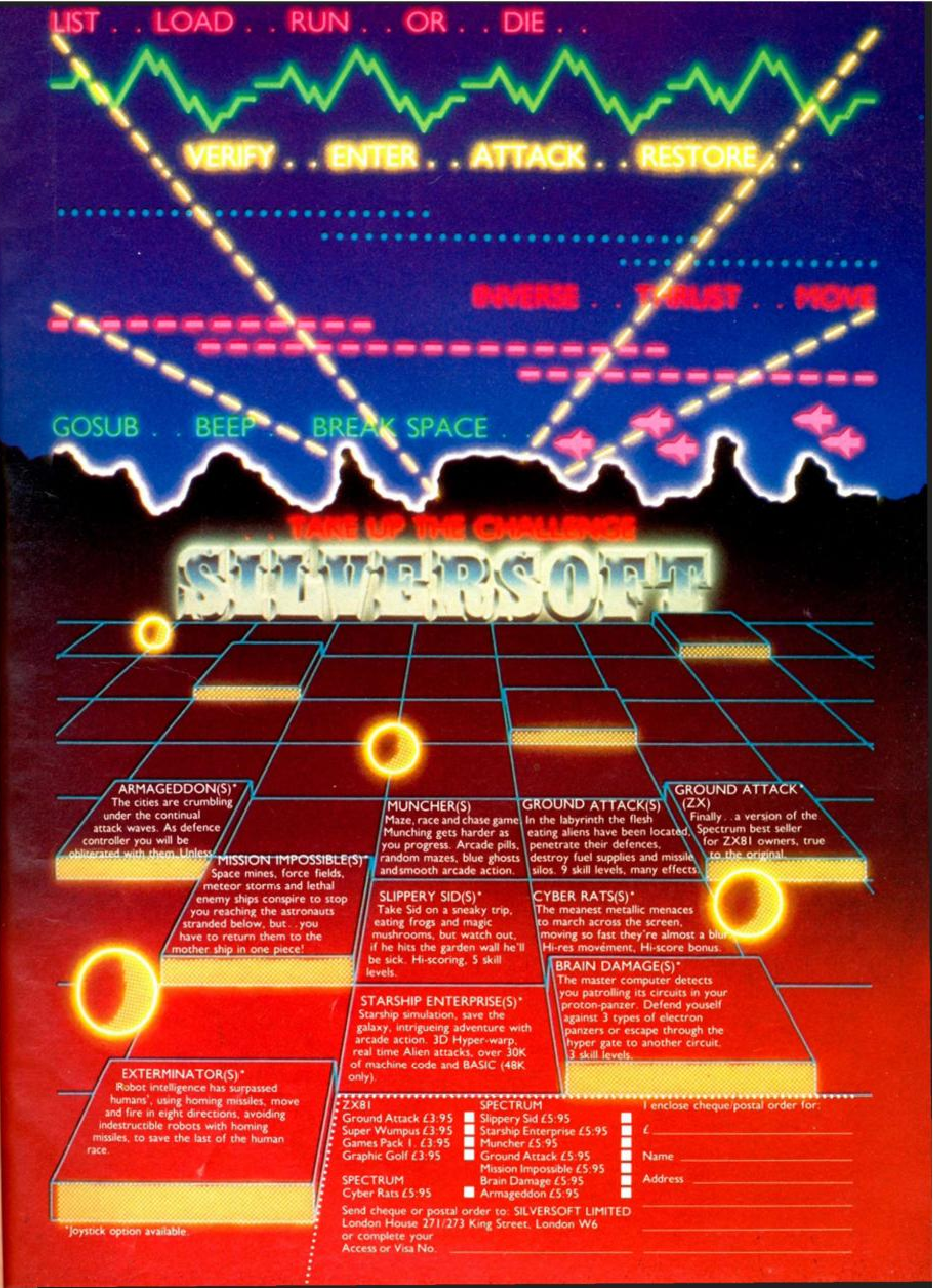
Reconnaissance alert

```
▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
 170 PRINT "▒▒ ";TAB 30;" ▒▒";"▒▒ "
;TAB 30;" ▒▒";"▒▒ ";TAB 30;" ▒▒"
 180 PRINT AT 6,15;"+"
 190 PRINT "▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒▒▒▒▒▒▒▒▒";A$;"▒▒ AIR SPEED
  A/H ▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒.
    ▒▒▒▒   ▒▒▒▒▒"
 200 PRINT "▒▒ 0"""""100"""""200""▒
▒▒      ▒▒▒";A$( TO 22);"--..O..-
-▒▒▒▒ HEADING ▒▒▒▒▒▒▒▒▒▒▒▒▒▒
 ▒▒▒"
 210 PRINT "▒▒▒                   ▒▒
▒▒      ▒▒▒▒""""100"""0"""100""""
;A$(20 TO );A$;"▒▒ ALTITUDE ▒▒▒  ▒▒
▒▒▒ AMMO▒▒  ▒▒▒▒▒";A$
 220 PRINT "▒▒ FLAPS ▒▒▒▒▒▒0  ▒▒";A$
(17 TO );A$;"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒
▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
 230 LET S=0
 240 LET F=0
 250 PLOT 21+H,14
 260 LET AH=0
 270 LET A=0
 280 LET AM=4
 285 PRINT AT 17,25;AM
 290 GOTO 420
 300 LET I$=INKEY$
 305 IF I$="F" THEN GOTO 600
 310 IF CODE I$>27 AND CODE I$<3
8 THEN GOSUB 5*VAL I$+500
 320 LET O=A
 325 LET A=A+AH
 326 IF A<0 THEN GOTO 850
 330 IF F=0 THEN GOTO 360
 340 UNPLOT 21+H,14
 350 LET H=H+F-31*(H>15)+31*(H<-
15)
 355 PLOT 21+H,14
 390 LET Z=H*PI/15
 400 LET X=X+S*SIN Z
 410 LET Y=Y+S*COS Z-ES
 415 IF D<20 AND ABS B<10 AND EA
>=O AND EA<=O+10 THEN PRINT AT 6
-(EA-O)/5,10+B;"  "
 417 LET EA=EA+5*INT (RND*3-1)+5
*(EA<5)
 420 IF X=0 THEN LET B=SGN Y*90+
90
 430 IF Y=0 THEN LET B=SGN X*90
```

```
440 IF X=0 OR Y=0 THEN GOTO 460
450 LET B=(ATN (X/Y)-Z)*180/3.1
415927
460 LET D=SQR (X*X+Y*Y)
479 IF D<20 AND ABS B<10 AND EA
>=A AND EA<=A+10 THEN PRINT A, 6
-(EA-A)/5,10+D;"--*==█==*--"
480 PRINT AT 1,12; INT B;"██";TA
B 26; INT D;"██";AT 17,12;A
490 GOTO 300
500 LET I$="10"
510 UNPLOT 5+S*6,22
512 LET S=S+(VAL I$-3)*(I$="1"
AND S>.2 OR I$="2" AND S>.1)/6+(
VAL I$-6)*(VAL I$>5 AND S<5)/6
515 PLOT 5+S*6,22
516 IF S>1.3 AND A=0 THEN GOTO
700
520 IF S<2 AND A=0 THEN GOSUB 9
00
523 RETURN
525 GOTO 540
535 PRINT AT 12-AH/5,24;"    "
536 LET AH=AH+5*(I$="7" AND AH<
10 AND S>.7)-5*(I$="6" AND AH>-1
0)
537 PRINT AT 12-AH/5,24;"▄▄ ▄▄"
538 RETURN
540 LET F=F+(I$="8" AND F<3)-(I
$="5" AND F>-3)
541 PRINT AT 19,12;F;" "
542 RETURN
545 GOTO 510
600 IF AM=0 THEN GOTO 315
601 PRINT AT 6,15;"█";AT 19,22;
"FIRE"
602 FOR I=1 TO 5
603 FAST
604 SLOW
605 NEXT I
606 PRINT AT 6,15;"+"
607 LET AM=AM-1
610 PRINT AT 17,25;AM;" "
613 IF D<10 AND EA=A AND ABS B<
5 THEN GOTO 650
615 GOTO 620
620 IF B>=5 THEN PRINT AT 19,21
"MISSED"
630 IF D>=10 THEN PRINT AT 19,1
8;"OUT OF RANGE"
635 FOR I=1 TO 25
640 NEXT I
642 PRINT AT 19,18;"████████████
█"
645 GOTO 315
650 PRINT AT 6,5;"        ** BOOM
**    "
660 FOR I=1 TO 40
670 NEXT I
675 CLS
680 PRINT AT 5,3;"THE MAJOR CON
GRATULATES YOU  ON SHOOTING DOWN
 THE ENEMY..          BUT LOOK OUT
 - HERE COMES   ANOTHER ENEMY PL
ANE. DO YOU WANTTO HAVE A GO AT
THIS ONE TOO ?"
685 LET I$=INKEY$
690 IF I$="" THEN GOTO 685
693 IF I$="Y" THEN GOTO 48
696 GOTO 999
700 PAUSE 6
701 PRINT AT 5,9;"** CRASH **"
702 FOR I=1 TO 50
703 NEXT I
704 LET A$="██████████████"
705 FOR I=1 TO 3
706 PRINT AT 19,21;"CRACKLE";AT
19,21;"███████";AT 19,21;"CRACK
LE";AT 5,9;"           ";AT 19,
21;"███████"
708 NEXT I
710 PRINT AT 19,17;"COME IN PLE
ASE"
714 FOR I=1 TO 20
715 IF I=5 THEN PRINT AT 19,17;
A$
716 NEXT I
720 PRINT AT 19,17;"DO YOU RECE
IVE ME"
723 FOR I=1 TO 35
725 IF I=5 THEN PRINT AT 19,17;
A$
726 NEXT I
730 IF INKEY$="" THEN GOTO 710
745 IF PLANES=0 THEN GOTO 800
750 PRINT AT 4,4;"RADIO MESSAGE
.    THE MAJOR";AT 5,2;"CONGRATUL
ATES YOU ON CRASHING";AT 6,2;"IN
TO THE END OF THE RUNWAY."
753 PRINT AT 4,4;
755 FOR I=1 TO 50
756 NEXT I
758 PRINT "...WE DO, HOWEVER, H
AVE ONE       PLANE  LEFT: DO YOU
WANT IT?
       "
759 LET PLANES=0
760 LET I$=INKEY$
770 IF I$="" THEN GOTO 760
780 IF I$="Y" THEN GOTO 110
790 IF I$<>"N" THEN GOTO 760
795 GOTO 999
800 CLS
805 PRINT "RADIO MESSAGE";AT 5,
3;"OH NO, NOT AGAIN. THE MAJOR
IS VERY ANGRY. THERE ARE NO
PLANES LEFT. DO YOU WANT TO JOIN
A DIFFERENT SQUADRON ?"
807 FOR I=1 TO 20
808 NEXT I
810 LET I$=INKEY$
820 IF I$="Y" THEN GOTO 48
830 IF I$="N" THEN GOTO 999
840 GOTO 810
850 PAUSE 7
851 PAUSE 7
855 CLS
856 IF PLANES=0 THEN GOTO 800
860 PRINT TAB 8;"** CRASH **";A
T 5,3;"YOU HAVE JUST ATTEMPTED T
O   BURROW A HOLE INTO THE GROUN
D,  CRASHING AND MAKING A MESS O
F   THE RUNWAY."
865 LET PLANES=0
870 GOTO 755
900 PRINT AT 19,21;"YOU HAD";AT
20,20;"RELOADED"
910 FOR I=1 TO 40
920 NEXT I
925 PRINT AT 19,21;"███████";AT
20,20;"████████"
930 LET AM=4
940 RETURN
```

A sample screen illustration of the program, Reconnaissance Alert.





LIST . . LOAD . . RUN . . OR . . DIE . .
VERIFY . . ENTER . . ATTACK . . RESTORE . .
INVERSE . . THRUST . . MOVE
GOSUB . . BEEP . . BREAK SPACE . .
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College computing

Nick Pearce goes back to college and takes a look at the library of advanced mathematics software from University Software.

University Software have produced five cassettes which comprise their library of advanced mathematics. They are designed to handle complex problems in various branches of mathematics.

These are utility, rather than teaching, programs, although instructions printed on the cassettes covers are 'intended to introduce the non-specialist to the theory'. In general, the instructions are adequate for this purpose.

Matrix Operation This program is designed to handle the usual matrix operations of Inversion, Multiplications, Addition, Subtraction and Scalar Multiplications. The operation required is selected from a menu at the start of the program. The user dimensions the matrices and enters the values of the matrices row by row. The program will not accept invalid instructions at this stage. For example, if you select the inversion operation the program will not accept a matrix with an unequal number of rows and columns (which cannot be inverted) and prompts the user for new matrix dimensions. Whilst there seems no limit to the matrix dimensions this program will accept, a 20 by 20 matrix is inverted in a little under seven minutes.

The program works well and data input is logically organised. However, I would have liked the option to alter individual values within a matrix; as the program stands, a mis-type during data entry necessitates re-typing of the complete matrix. On the reverse side of the cassette is Determinants, a program which computes the determinant by means of converting a matrix into a triangular matrix by the appropriate row transformations.

Polynomials This program also severely tested my knowledge of such things. A polynomial is an expression of the form:

$$F(x) = C_nX^n + C_{n-1}X^{n-1} + \ldots + C_2X^2 + C_1X + C_0$$

where $C_n \ldots C_0$ are coefficients and n is the degree of the polynomial. The program calculates the roots of a polynomial expression, ie the values of x which satisfy $F(x) = 0$ (real roots only).

The program employs three different methods. If the expression has two degrees the familiar formula for solving quadratic equations is used; for higher degree polynomials interactive methods are used, either the Newton-Raphson method (which I recall) or the Half-Interval Search method (which I don't).

On the B side is Plot of Polynomials, a program which plots the polynomial equation between given limits. This works very well, you input the degree and coefficients of the polynomial as before, and the range over which it is to be plotted. The program scales the axes and plots the equation accordingly, and also labels the extreme values of the axes. If a root is found the value of the root is printed at the point of intersection.

Integration On more familiar territory now, I can clearly recollect counting up squares to calculate the area under curves. This program evaluates the integral of functions between given limits by Simpson's and Trapezoidal rules. Two functions can be integrated simultaneously, allowing the area between two curves to be evaluated.

Again, a program to plot the function is given on the B side. This plots two functions between given intervals and cross-hatches the area between them. To evaluate the integrals the A side has to be used.

Regression On even more familiar ground, regression analysis is a technique I have had occasion to use recently. I devised for myself a short program for the ZX81; it worked adequately but could only handle one independent and one dependent variable. University Software's program is somewhat more elaborate and will solve a 'multivariate' linear regression problem.

The user enters the number of observations and the number of independent variables. For each observation the values of the associated variables are entered. Data entry is a little tedious, and again there is no way to correct a mis-typed figure — if you make a mistake you have to re-type from scratch. The program can deal with both exponential and logarithmic regressions.

The program calculates the equation coefficients, and gives the values of r^2, corrected r^2 (r^2 adjusted for the degrees of freedom), the F-statistic, standard error of regression, Durbin Watson statistic, and the t-statistic. Side B plots the regression line together with the numbered data points for a 'bivorate' regression — the sort of regression I understand. It gives the slope and intercept of the fitted line and the standard error and r^2 of the regression.

Linear Programming This is where things started to get difficult again. The cassette is certainly no substitute for a good textbook on the subject, but having mastered the theory it can be of considerable assistance in the solution of linear programming problems.

This optimization program is capable of handling any sort of linear programming problem with up to 20 variables and 20 constraints. After data entry, the original form of the problem (the primal) is displayed together with the solution — or with a report that the problem is either unfeasible or unbounded. A second display gives the canonical equivalent of the primal, its solution and the variable relationships or the primal and canonical. A third displays the dual and its solution.

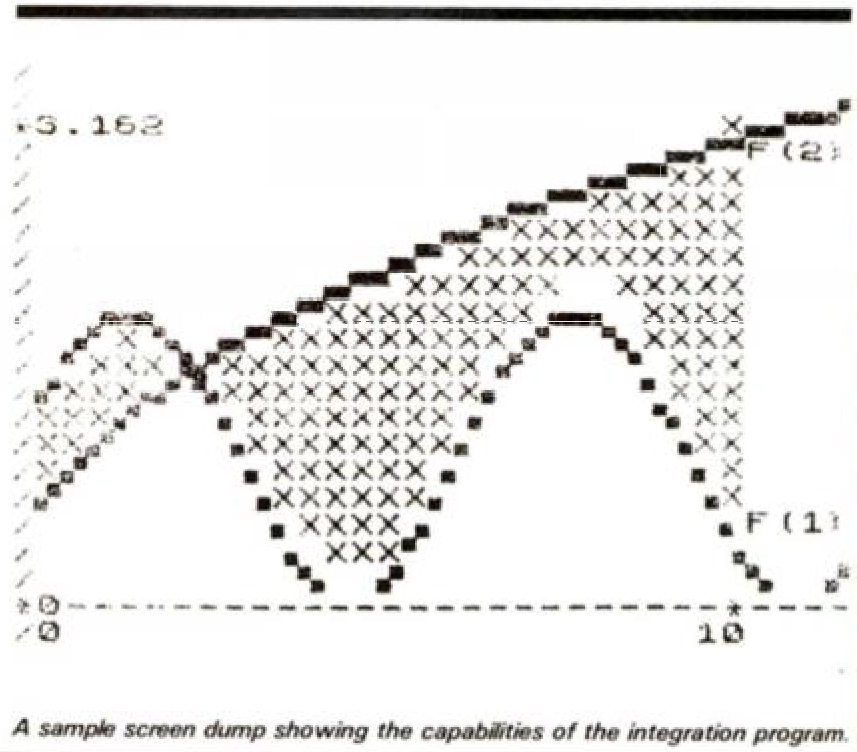
Side B deals with simultaneous equations.

All of these University Software programs run automatically once loaded, and prompts to guide the user are given on screen. The programs are all written in BASIC and can be listed, enabling the user to see how they work, or modify them. Output displays can be copied onto a printer.

These are not teaching programs, but they take the tedium, and the human error, out of mathematical problem solving and will be a valuable aid to the serious user and student alike. They all perform well have obviously been carefully prepared.

University Software also offer to prepare more specialised programs to order.

University Software is at 45/c Sloane Street, London SW1X 9LU. Matrix Operation, Polynomials and Integration cost £6.95 each; Regression and Linear Programming are priced at £7.95 each.

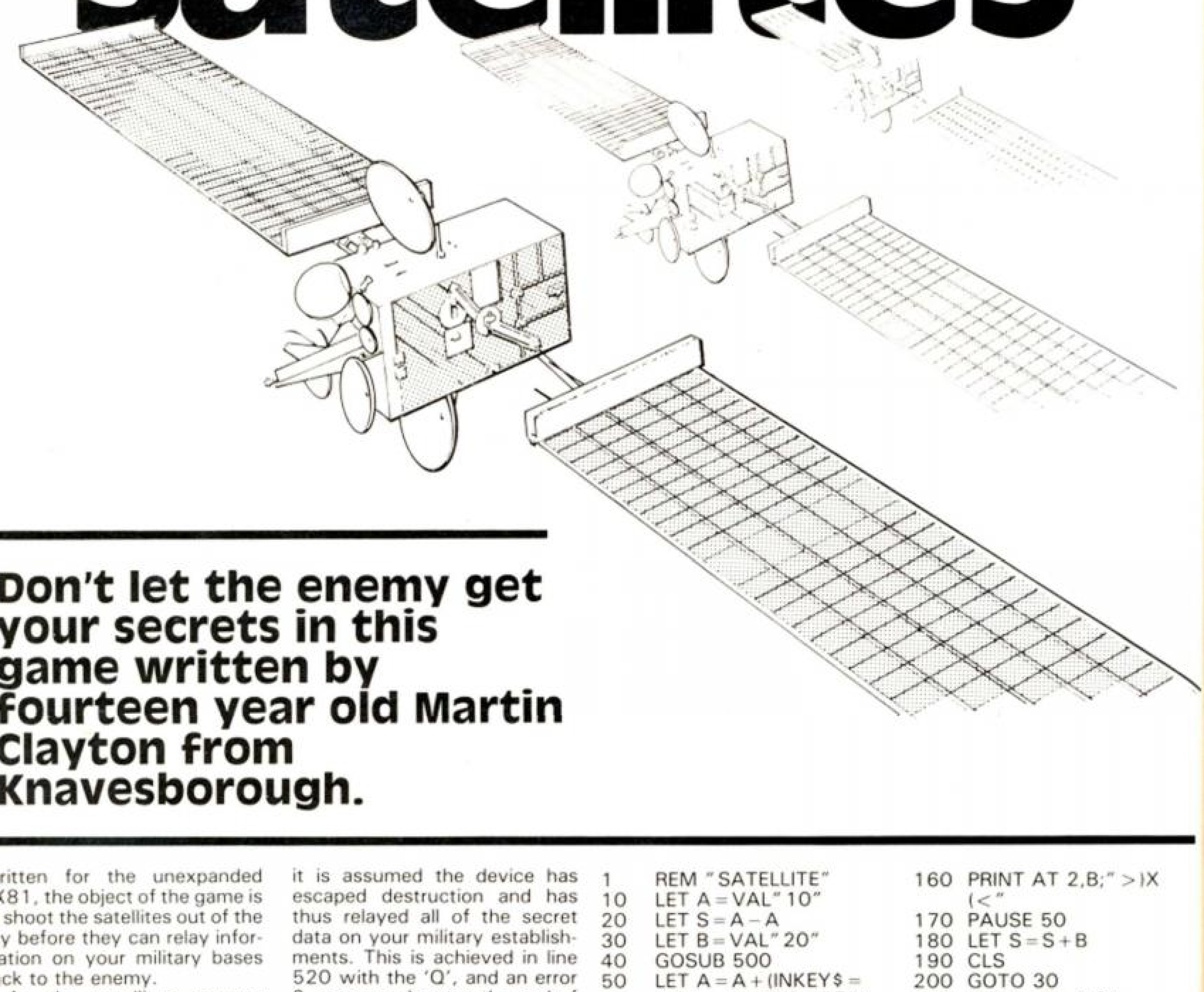


A sample screen dump showing the capabilities of the integration program.



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Enemy satellites



Don't let the enemy get your secrets in this game written by fourteen year old Martin Clayton from Knavesborough.

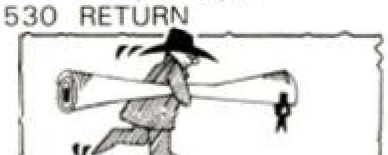
Written for the unexpanded ZX81, the object of the game is to shoot the satellites out of the sky before they can relay information on your military bases back to the enemy.

As the satellites traverse across the top of the screen, it is your job to move the ground to air missile launcher until you can get a good shot at the enemy device. Movement of the missile launcher is achieved by pressing the '5' key to go left and the '8' key to move right. Key '0' is used to launch a missile at the satellite.

Should a satellite reach the far left-hand side of the screen, it is assumed the device has escaped destruction and has thus relayed all of the secret data on your military establishments. This is achieved in line 520 with the 'Q', and an error 2 message denotes the end of the game.

To hit a satellite, you must aim for the 'O' character of the device. If you do manage to destroy the satellite, line 160 causes an explosion to be displayed: this is followed by a PAUSE statement causing the screen to blink (just to add a touch of realism). When the game finishes, your score is displayed.

```
1   REM "SATELLITE"
10  LET A=VAL"10"
20  LET S=A-A
30  LET B=VAL"20"
40  GOSUB 500
50  LET A=A+(INKEY$=
    "8")-(INKEY$="5")
60  IF INKEY$="0" THEN
    GOTO 100
70  GOTO 40
100 FOR N=10 TO 2 STEP
    -1
110 GOSUB 500
120 PRINT AT N,A+2;" * ";
    AT N+1,A+2;"  "
130 NEXT N
140 IF A=INT B THEN
    GOTO 160
150 GOTO 40
160 PRINT AT 2,B;" >)X
    (< "
170 PAUSE 50
180 LET S=S+B
190 CLS
200 GOTO 30
500 LET B=B-0.25
510 PRINT AT 2,INT B;"
    =O=  ";AT 11,A;
    "  ▞ * ▚  "
520 IF B<0.2 THEN PRINT
    AT 2,0;"GAME OVER
    -  ";INT S;Q
530 RETURN
```



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Invincible

Try playing hard to get in this program by David Price of Caerphilly. The aliens are out to get you . . .



Photograph courtesy of the Ladd Company.

The object of this game is to shoot the alien spaceship five times before it gets to shoot you. You use the '1' key and the 'Q' key to move left and right respectively. You can fire at the spaceship using the 'O' key.

You must make sure your shots are aimed at the black squares of the spaceship — all other hits are counted as naught. The winner of the game is the first one to get five hits. The seemingly random firing of the spaceship is accomplished using the RND function.

The game is great fun to play and beating the spaceship is no easy task!

```
   1 PRINT "          ████████
█",,"          █INVINCIBLE█",,"
  ██████████"
   2 PRINT AT 5,0;"USE █ TO MOVE
 LEFT","USE █ TO MOVE RIGHT","US
E █ TO FIRE"
   3 PRINT AT 10,0;"YOUR SHOTS C
AN PENETRATE THE ","BLACK SQUARE
S ONLY"
   4 PRINT AT 14,0;"FIRST ONE TO
 SCORE 5 HITS WINS"
  10 PRINT
  12 PRINT "PRESS ANY KEY TO STA
RT"
  20 PAUSE 4E4
  90 CLS
 100 LET A=0
 101 LET SH=0
 102 LET ZX=0
 103 LET SK=0
 104 LET ZK=0
 105 LET A$="█▒█▒█▒█▒█▒█▒█▒█▒█▒█▒
▒█▒█▒█▒█▒█▒"
 110 LET B=1
 120 LET C=2
 130 LET D=3
 140 LET E=18
 150 LET H=INT (RND*25)
 160 LET F=17
 170 LET G=INT (RND*25)
 300 LET Q=INT (RND*4)
 500 PRINT AT A,A;"██████████
████████████████████";AT E,A;"██
████████████████████████████████"
 510 PRINT AT B,H;" ███ "
 520 PRINT AT F,G;" █ █ "
 530 PRINT AT 9,A;A$;
 540 IF Q=1 THEN LET H=H-1
 550 IF Q=2 THEN LET H=H+1
 555 IF Q=3 THEN GOSUB 1500
 560 IF H>=26 THEN LET H=26
 561 IF H<=0 THEN LET H=0
 565 IF G>=26 THEN LET G=26
 566 IF G<=0 THEN LET G=0
 600 IF INKEY$="1" THEN LET G=G-
1
 610 IF INKEY$="Q" THEN LET G=G+
1
 620 IF INKEY$="0" THEN GOSUB 10
00
 900 GOTO 300
1005 LET SH=SH+1
1008 FOR I=14 TO 1 STEP -1
1010 PRINT AT I,G+2;".";
1020 PRINT AT I,G+2;" ";
1030 IF PEEK (PEEK 16398+256*PEE
K 16399)=128 THEN GOTO 2000
1040 IF PEEK (PEEK 16398+256*PEE
K 16399)=129 THEN GOTO 1200
1060 NEXT I
1100 RETURN
1200 PRINT AT B,H;"▒▒▒▒▒"
1205 LET SK=SK+1
1210 IF SK=5 THEN GOTO 2500
1220 GOTO 300
1500 FOR I=2 TO 17
1501 PRINT AT I,H+2;"."
1505 PRINT AT I,H+2;" "
1510 NEXT I
1512 LET ZX=ZX+1
1520 IF H+2=G+2 THEN GOTO 1700
1600 RETURN
1700 PRINT AT F,G;"▒▒▒▒▒"
1705 LET ZK=ZK+1
1710 IF ZK=5 THEN GOTO 2500
1720 GOTO 300
2000 PRINT "▒"
2002 GOTO 300
2500 CLS
2510 PRINT AT 1,0;"**********GAM
E OVER**********"
2520 PRINT AT 3,0;"ZX81 SHOTS =
";ZX
2530 PRINT
2540 PRINT "ZX81 KILLS = ";ZK
2550 PRINT
2560 PRINT
2570 PRINT "HUMAN SHOTS = ";SH
2580 PRINT
2590 PRINT "HUMAN KILLS = ";SK
2600 PRINT
2610 PRINT
2620 PRINT "PRESS ANY KEY TO TRY
 AGAIN"
2630 PAUSE 4E4
2660 GOTO 90
```

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For those just setting out on the road to real computing, these packs transform the ZX81 from a toy to a powerful computer. Data storage, extended programming and complex displays all become feasible. Further details available on request.

16K Memopak £24.95 32K Memopak £34.95
64K Memopak £49.95 Prices inclusive of VAT

MEMOPAKS ARE AVAILABLE AT MAIN BRANCHES OF WH SMITH and JOHN MENZIES

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The Assembler allows you first to code and edit a source program in the Z80 language, and then assemble it into machine code. You can now write flexible and economic programs.
The Editor mode allows you to code directly in the right format, manipulate individual lines and control the exact placing of source and machine code. Routines may be merged or listed (even to a commercial printer using our Centronics Interface). The assembler mode handles all standard Z80 mnemonics, numbers in hex or decimal, comments and user-selected labels.

£29.90 inc. VAT



Memotech Keyboard

The Memotech plug-in Keyboard plus buffer pack takes the effort out of data entry for ZX81 users. The Keyboard has a light professional touch and is housed in an elegant aluminium case. The simple plug-in system means that you are not obliged to open up your ZX81, use a soldering iron or invalidate your ZX81 warranty.

Keyboard Buffer Pak

The Buffer Pak performs a "housekeeping" function for the Keyboard, interfacing directly with the port of your ZX81.

£34.95 inc. VAT



All Prices are inclusive of VAT, postage and packing.

To Order: Send your Name, Address, Memopaks required, plus a Cheque/Postal Order/Access/Barclaycard number (please state which) to: Memotech Limited, Station Lane Industrial Estate, Witney, Oxon. OX8 6BX. Telephone Witney 2977

We want you to be completely satisfied with your Memopak – all our products carry a 14 day money back guarantee.



It's in the box

Peter Shaw takes the lid off the Fuller Master Unit and tells us what he found there.

Fuller, the Liverpool based company who have brought you add-ons for the ZX81 and Spectrum in great quantities in the past, have come up with the goods once again with a very useful peripheral for the ZX Spectrum.

Does it measure up?

The Master Unit itself is built into a tough black plastic box measuring 8cm by 24cm by 3cm. The connector at the back of the Master Unit is strong and forms a good and healthy connection with the Spectrum. The unit also has a connector at the back allowing you to make the outputs you would from the Spectrum itself.

The Master Unit can perform a wide range of fancy tricks although its main feature is speech. The unit is capable of forming a large number of phonemes, all of which are clear, easy to use and, more importantly, easy to understand.

You use the Master Unit's speech facility by sending a chosen number in port 159, ie if you say 'OUT 159,x' where x would be phoneme you wish to be enunciated. The speech demo supplied with the unit was not amazing but was adequate to test the unit's prowess. There are also rumours to suggest that there might be software coming soon from Fuller themselves which could drive the speech unit as well as providing a well written arcade game.

Zap! pow!! boom!!!

The next feature the Master Unit offers is three channel sound — a very useful addition to the limited voice of the Spectrum. Unfortunately, the demo tape to illustrate the capabilities of this facility is not that good, just providing some sample arcade zaps and explosions before giving you a do-it-yourself sound generator program. However, as I found, it is very worthwhile 'doing it yourself' as some of the noises you can come up with are fantastic.

But the unit doesn't stop there! It also has a joystick port for Atari-type joysticks which works very well with a lot of the software I have. The Master Unit also has an on-board cassette interface which enhances all the signals from the Spectrum and allows you to keep both EAR and MIC plugs connected at the same time.

We shall not be moved

The Fuller Master Unit sounds amazing, doesn't it — and it is. I'm not going to take it off the back of my Spectrum for a long time.

You can buy the Master Unit for £54.95, or if you would prefer a cheaper version which has all the features of the Master Unit except the speech, you can get one for £29.95.

For more information on the Master Unit or any other Fuller products, get in contact with Fuller Micro Systems, The ZX Centre, Dale Street, Liverpool 2. Telephone enquiries can be made on 051-236 6109.

sinclair special 1



Inside...
Latest prices round-up...
Latest software...
Order form...

Introduction

One thing's certain about the Sinclair world – there's never a dull moment.

Every month sees new software and new hardware, produced by Sinclair enthusiasts, or produced by Sinclair itself.

The magazines do a fantastic job of keeping you up to date with the input of enthusiasts. We want to keep you in touch with Sinclair's own developments.

Every month, there'll be a Sinclair Special in this magazine.

Sometimes, inevitably, there won't be anything new to say – we want to break away from the breathless announcements of hardware and software you just can't buy.

But when something new *is* available, we want you to have accurate information – fast. You'll find it here.

This month, we're giving you the latest information on the recommended retail prices of Sinclair equipment. They're *our* prices, and you may well find things cheaper (or dearer) in the shops. If they're cheaper – terrific! Snap them up. Note, however, that from us the ZX81 is down to £39.95.

We're also announcing six superb new Sinclair cassettes for the Spectrum, and three more which make full use of the ZX81. There's an order form at the back of this Special.

Next month... but there, next month is another story! Watch (as they say) this space.

Nigel Searle

Nigel Searle.
Managing Director,
Sinclair Research Ltd.



Spectrum – latest recommended retail prices.



16K was £125.00

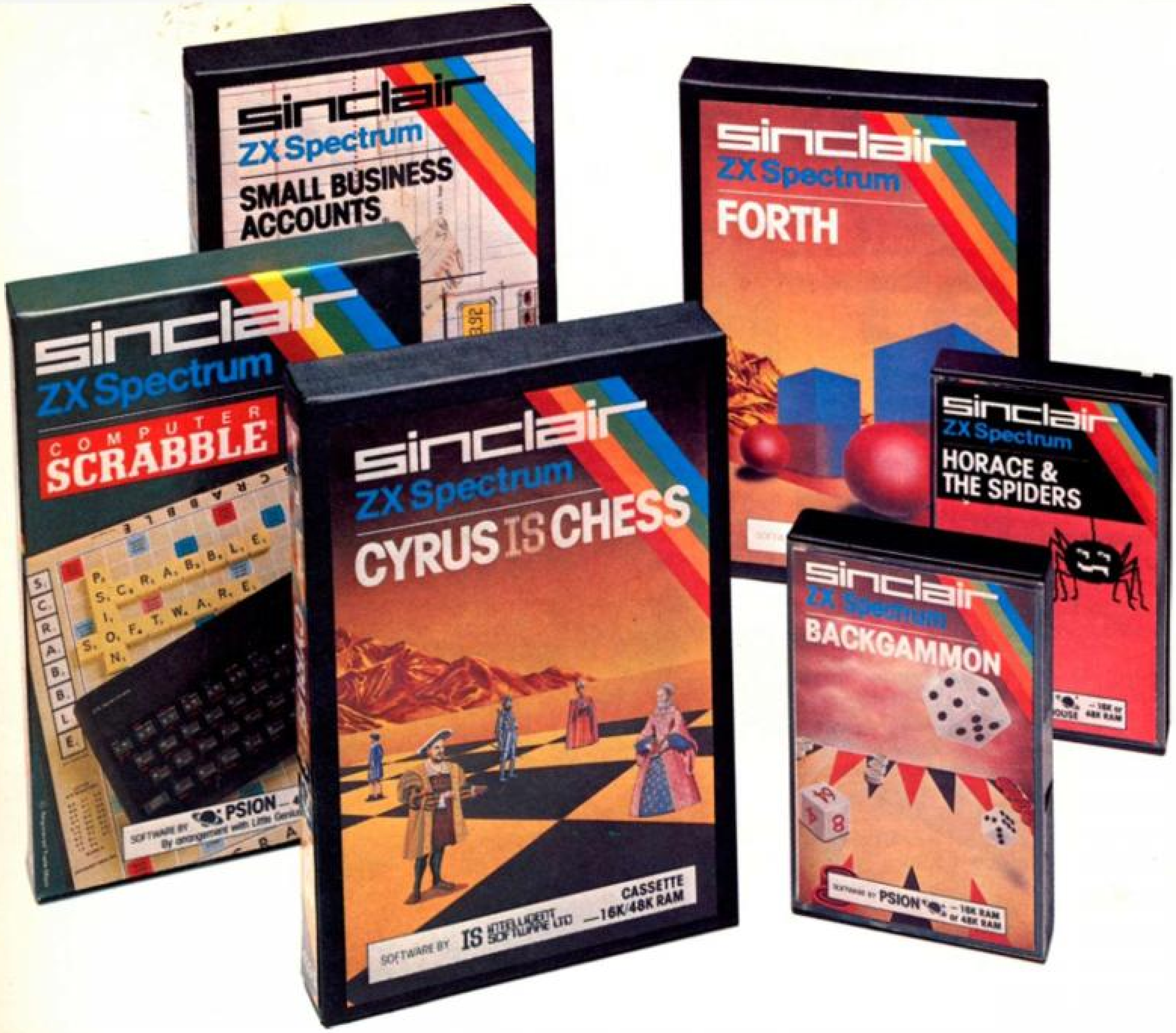
16K now £99.95

48K was £175.00

48K now £129.95

ZX Printer was £59.95 *ZX Printer now £39.95*

ZX81 was £49.95 *ZX81 now £39.95*



Six new ways to make more of your Spectrum.

Take a look at these brand-new titles. Each is an outstanding new program using the full potential of the Spectrum, for games with stunningly animated graphics, for strategies of fiendish cunning, for masterly applications of computing capability...

Cyrus-IS-Chess Based on the Cyrus Program, which won the 2nd European Microcomputer Chess Championship *and* trounced the previously unbeaten Cray Blitz machine. With 8 playing levels, cursor piece-movement, replay and 'take-back' facilities, plus two-player option. The 48K version has many additional features including an extensive library of chess openings. For 16K or 48K RAM Spectrum.

Horace and the Spiders Make your way with Horace to the House of Spiders, armed only with a limited supply of anti-spider-bite serum. In the house, destroy the webs before the spiders can repair them. Then destroy the spiders, before *they* destroy Horace! Undoubtedly the creepiest Horace program ever produced! For 16K or 48K RAM Spectrum.

Computer Scrabble The famous board game, on-screen – with the whole board on view! A huge vocabulary of over 11,000 words. Full-size letter tiles, four skill levels – the highest of which is virtually unbeatable. For 1 to 4 players. For 48K RAM Spectrum.
(SCRABBLE trademark and copyright licensed by Scrabble Schutzrechte und Handels GmbH – a J.W. Spear and Sons PLC subsidiary.)

Backgammon A fast, exciting program, with traditional board display, rolling dice and doubling cube. Four skill levels. For experts – or beginners. (Rules are included – it's the quickest way to learn the game.) For 16K or 48K RAM Spectrum.

FORTH Learn a new programming language, as simple as BASIC, but with the speed of machine code. Complete with Editor and User manual. For 48K RAM Spectrum.

Small Business Accounts Speeds and simplifies accounting work, produces Balance Sheets, Profit and Loss information *and* VAT returns. Complete with User manual. For 48K RAM Spectrum.

Overleaf–your Sinclair order form.

Three new ways to get the best out of your ZX81.

The range of Sinclair software for the ZX81 continues to grow.

These three new cassettes offer two totally different challenges to you and your ZX81. The games – like so many ZX81 games today – really do use the ZX81's capability. The FORTH program is a fascinating extension of your own computer understanding.

Sabotage Defender or attacker? The choice is yours in this exciting game.

Be the Guard and defend the randomly placed boxes of ammunition inside the compound – or be the Sabateur and attack the ammunition!

Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

City Patrol You are the Commander of a laser-firing ship. Your task is to intercept and destroy alien suicide ships descending on your city. Judge your rating as Commander by how many aliens you destroy and how much of your city survives.

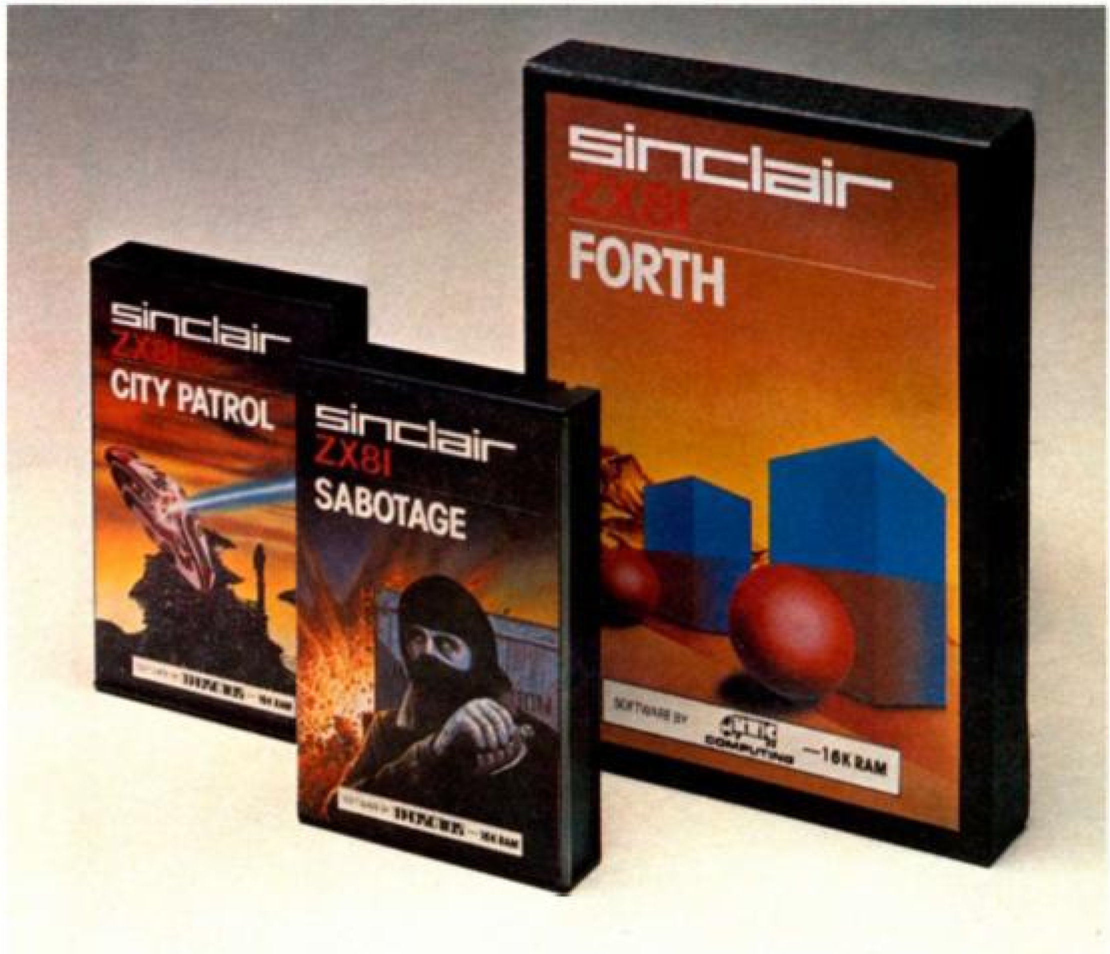
Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

FORTH Discover a new programming language which combines the simplicity of BASIC with the speed of machine code.

FORTH's compiled code occupies less than a quarter of the equivalent BASIC program and runs ten times as fast. It is fully extendable by the addition of user-defined commands.

Free User-Manual and Editor Manual with each cassette.

Written by Artic for a ZX81 with 16K RAM. Cassette price: £14.95.



How to order

Simply fill in the relevant section(s) on the order form below. Note that there is no postage or packing payable on Section B. Please allow 28 days for delivery. Orders may be sent FREEPOST (no stamp required). Credit-card holders may order by phone, calling 01-200 0200 24 hours a day. 14-day money-back option.

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ORDER FORM

Section A: hardware purchase

Qty	Item	Code	Item Price £	Total £
	ZX Spectrum – 48K	3000	129.95	
	ZX Spectrum – 16K	3002	99.95	
	ZX 81 (including 1.2A Mains Adaptor)	1003	39.95	
	16K RAM pack for ZX81	1010	29.95	
	ZX Printer	1014	39.95	
	1.2A Mains Adaptor, for use with ZX81 computer/ZX Printer combination (only required if you have an early ZX81 with 0.7A Adaptor)	1002	7.95	
	Printer paper (pack of 5 rolls)	1008	11.95	
	Postage and packing: orders under £90	0028	2.95	
	orders over £90	0029	4.95	
			TOTAL £	

Section B: software purchase

Qty	Cassette	Code	Item Price £	Total £
	FOR SPECTRUM			
	G22/S:Backgammon	4021	5.95	
	G23/S:Cyrus-IS-Chess	4023	9.95	
	G24/S:Horace & the Spiders	4022	5.95	
	G25/S:Scrabble	4024	15.95	
	L1 /S:FORTH	4400	14.95	
	B6 /S:Small Business Accounts	4605	12.95	
	FOR ZX81			
	G25: Sabotage	2124	4.95	
	G24: City Patrol	2123	4.95	
	L1: FORTH	2400	14.95	
			TOTAL £	

*I enclose a cheque/postal order made payable to Sinclair Research Ltd for £ ________

*Please charge to my Access/Barclaycard/Trustcard account no:

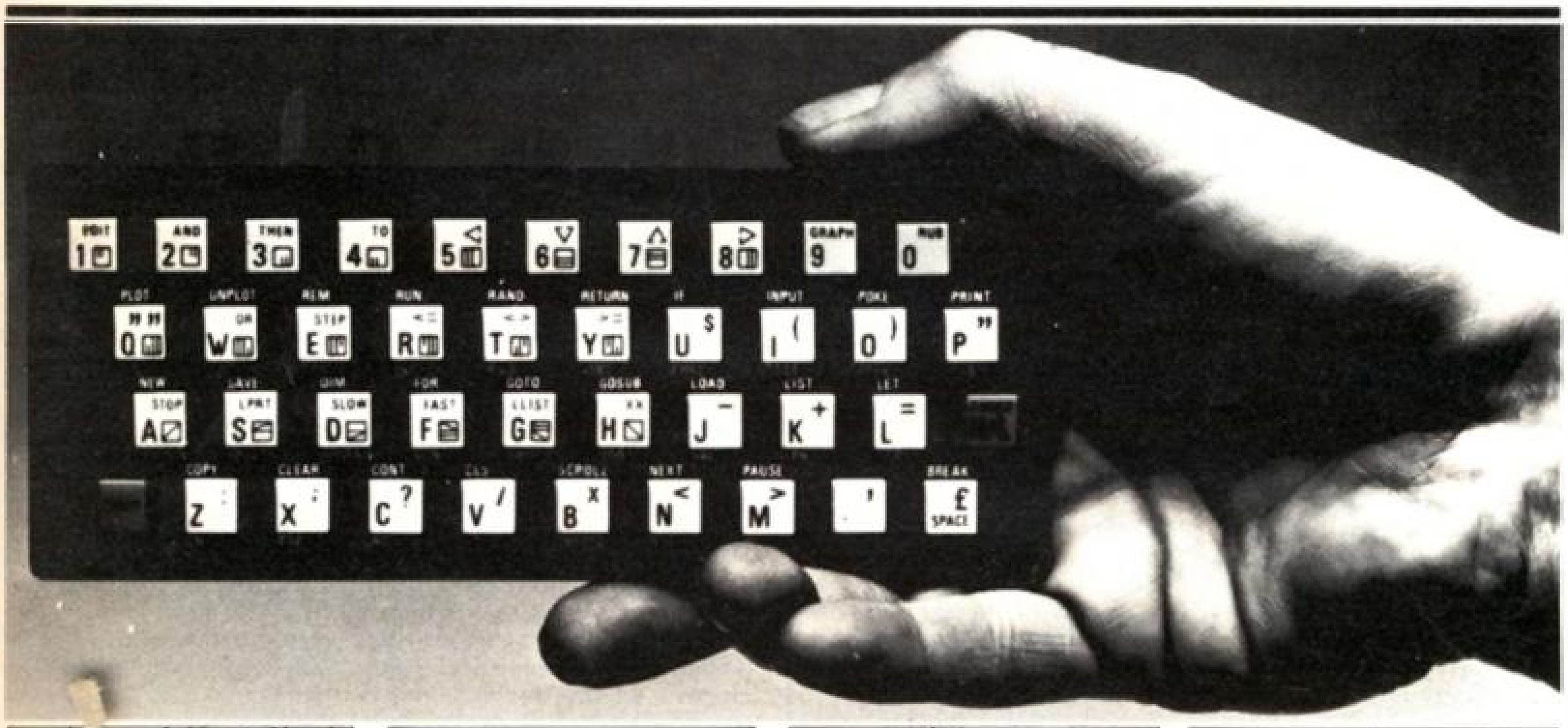
*Delete/complete as applicable. (Please print)

Signature | Mr/Mrs/Miss

Address

ZXC908

NOW. A ZX81 PUSH-BUTTON KEYBOARD FOR UNDER £10.





1. Make sure the original keyboard is clean and check that all the keys function.



2. The Buttonset is held in place by self adhesive pads.



3. So all you do is remove the protective backing.



4. And place it centrally on your ZX81.

At last there's a really cheap but efficient way of ironing out the ZX81's only real bug: its keyboard. The Filesixty Buttonset offers:

■ A full-travel calculator-type moving keyboard for only £9.95. ■ Installed in seconds. The peel-off adhesive backing means you just register into position and press. ■ No messy labels, dismantling or soldering. ■ 3 groups of colour keys to pick out shift, numerals and newline. ■ Precision moulded in ABS to match your ZX81, with contrasting legends for maximum legibility.

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Please send me ________ (qty) Buttonset(s) at £9.95 each (including VAT and P&P).

Total £ ________ BLOCK CAPITALS

Name ________

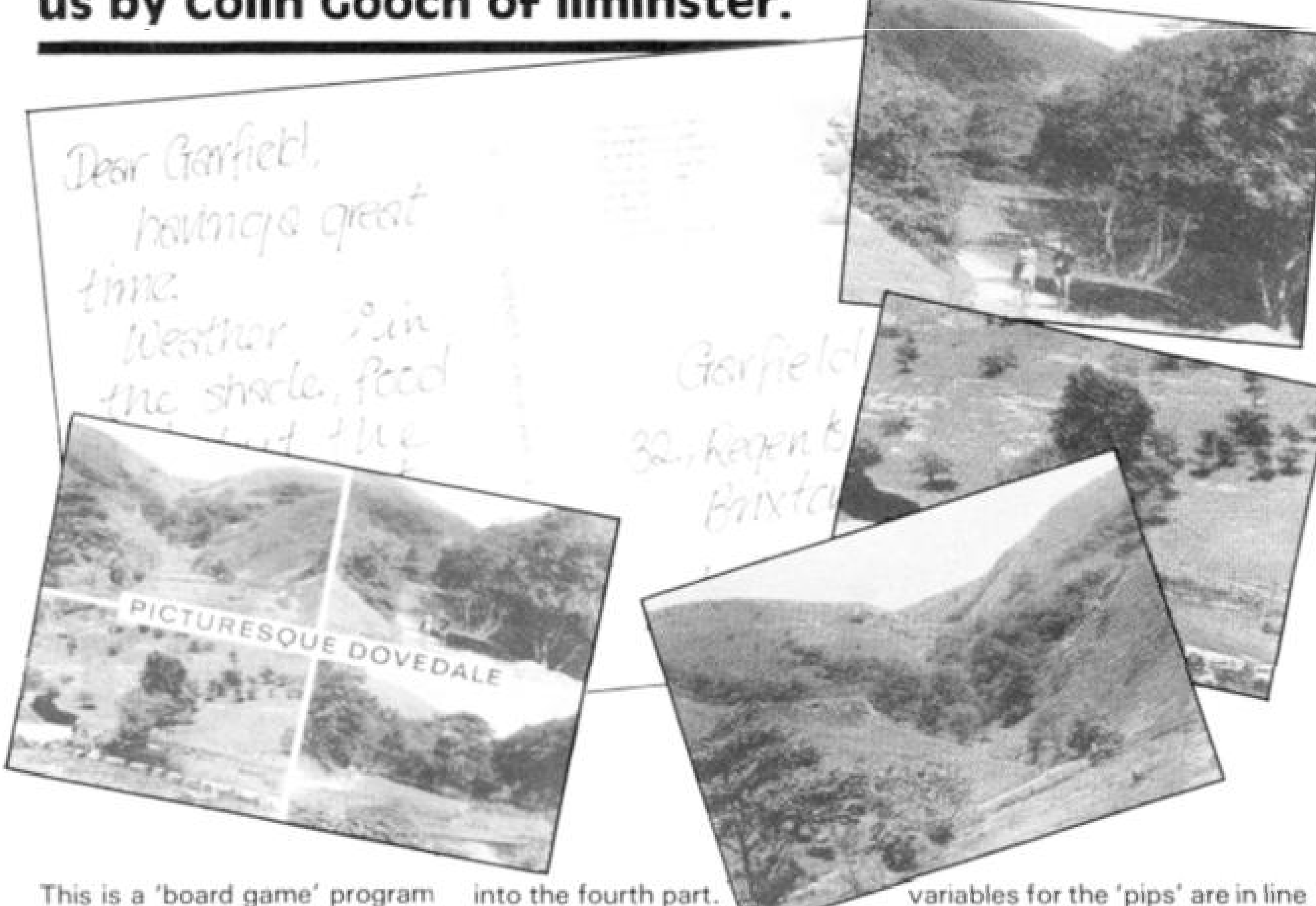
Address ________

ZXC6 83

FILESIXTY

Tourist trap

Get the holiday horrors in this spectacular board game for your 48K Spectrum, written for us by Colin Gooch of Ilminster.



This is a 'board game' program for two people to play against each other, rather than one person against the computer. It is a fairly large program using a major portion of the 48K RAM available on the larger Spectrum. This means that SAVEing and LOADing will take quite some time. The playing of one game usually takes something like 40 minutes.

You can consider the program as operating in four main parts:

1) The initialisation of values and graphics, the printing of the instructions and then the playing board display.
2) The dice calling routine to decide your throw.
3) The moving of your piece and the diversion if required at that new position onto a subroutine which will decide your score for that throw.
4) The end game routine.

After the first part has been executed, lines 120 and 130 will keep the program looping through the second and third parts, automatically changing the players, until the end game condition is fulfilled to break out into the fourth part.

Going fourth

The four sections operate as follows:

Part One Lines up to 100 call all the initialisation routines. Line 9000 allows the instructions to be displayed while the user-defined graphics are set up. These are the two playing pieces, plus a number of odd shaped 'blobs' used to create pictures in the course of play. The board printout begins at line 8000. The PLOT/DRAW facility draws out a playing track around the outside of the display area allowing the centre to remain clear for the various graphics routines. The playing squares are numbered using different combinations of INK, PAPER and BRIGHTness, these being controlled by the DATA statements at line 8000. It is the attributes on these squares that will decide the 'fate' of a player landing on them. It is *most* important that these are not altered or you will not be sent to the correct subroutines.

Part Two The dice routine is a straightforward affair. The variables for the 'pips' are in line 8300 onward and it is printed out as required by GOSUB 8425. To roll the dice you press Enter and keep it pressed until you think you have the number you want. Removing the pressure will stop the dice.

Part Three Moving the pieces around the board is more complicated. It is done by a series of FOR . . . NEXT statements. These take the value of the dice thrown as the second control value in the statement and move the piece along that number of squares. If that line runs out of squares then the next FOR . . . NEXT loop will use up the surplus. (I'm usually fond of conditional statements, but in this case found this system operated in a speedier manner.)

On arriving at a square, the attributes of the number of that square is read. If it is 104 then that turn ends, line 6660 changes over the player and your opponent will have their turn. If it is anything other than 104 then the value is converted to a GOSUB line and off you go to see what fate has in store.

The bulk of the program consists of these subroutines which I will let you discover for yourself. The operation of these routines is fairly straightforward. There are nice things that will happen, not so nice things and, of course, some disasters — all of which lose or gain you points, lose you money and use up your petrol. If you run out of petrol, you will have to pay for a rescue and if you are on the way to a location, you will lose the rest of that turn. The game ends when one person runs out of money . . . but the winner is the one with the most points, so towards the end of a game tactics can become important!

Part Four Brief and simple. Once one person is out of money, line 130 fails to maintain the loop and the 'game over' signal shows. The final scores are then displayed. The score display routine is at line 8600 and is used at intervals throughout the game. Line 8610 ensures that petrol and money are only displayed to two decimal places; without this line you'll find that as the game progresses you end up with petrol designated in scientific notation!

Easy to enter?

Debugging a program of this size can be a bit daunting and so I would suggest it is entered in sections. Enter the program as listed but omitting all the subroutines from line 1000 to 6490. This will allow you to get the board display and the piece moving routines all in working order. To do this enter a temporary line, 6480 RETURN. RUNning the program will then result in everything happening except any of the scoring subroutines. The subroutines can then be entered one at a time and tested out. There is no need to keep going round the board to test these, just let the Spectrum print out the board, then break into the program and type in GOTO (the appropriate routine) and all will be well. (The 'Press enter to continue' uses the form 'INPUT:LINE Z$' which means that the usual Break and Stop keys will not work. Never fear. Use Caps Shift and '6' and you will get a 'stop in input' message.) The 'out of petrol' routine is the most difficult to test and may best be left until you are happy with the others.

Most of the graphics are straight off the keyboard. The only user-defined graphics that are vital are those for the two playing pieces and the dots on the dice. The others are not so vital but if you enter and RUN line 9000 to 9140 fairly early on, it is easy to see which keys are required.

We're off . . .

When all is entered and you are ready to play you will first of all see the instructions, then the Spectrum will choose at random someone to start. The board is then printed out; the player whose turn it is will be shown on the right-hand margin. If you throw the dice and land on a square that is not blue then some graphics and instructions will appear in the centre of the screen. To continue to play, simply follow all the prompts. To enter in the spirit of it all, you must imagine that you are on tour in a car, with a tent, and have the opportunity to visit various places . . . wild life parks . . . castles . . . the sea and so on.

So off you go. Happy Holiday.

Variables

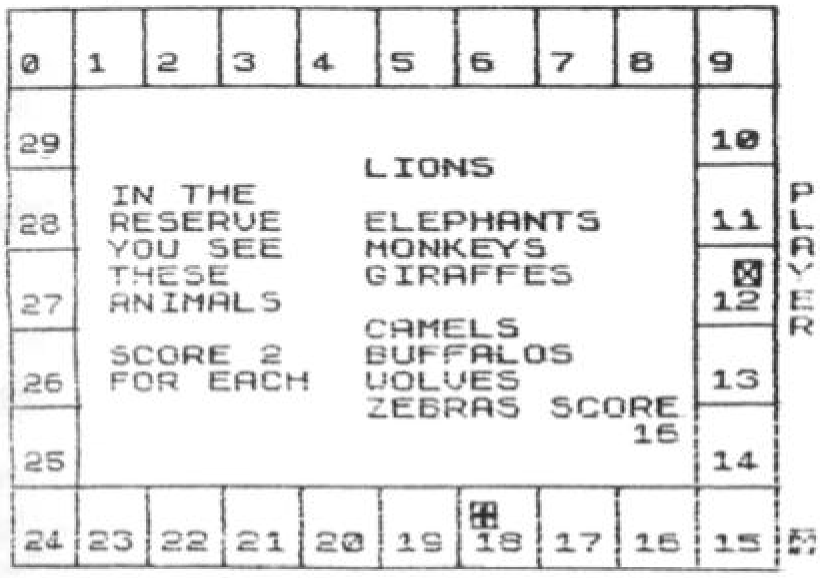
The main variables used are:

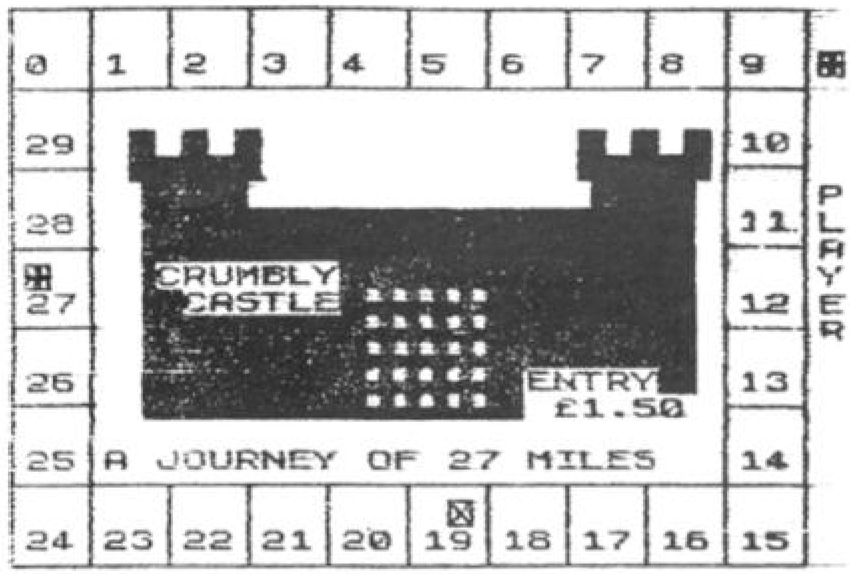
C(x)	Cash on hand.
D	Value of dice throw.
H(x)	Horizontal position of playing piece.
J(x)	Total score.
LO	Flag indicating turn to be lost.
MI	Miles to travel.
P(x)	Petrol in gallons.
PL	Player.
SUB	Subroutine in use.
TI	Flag to check the number of times the petrol is evaluated.
V(x)	Vertical position of playing piece.
Z$	Line input.

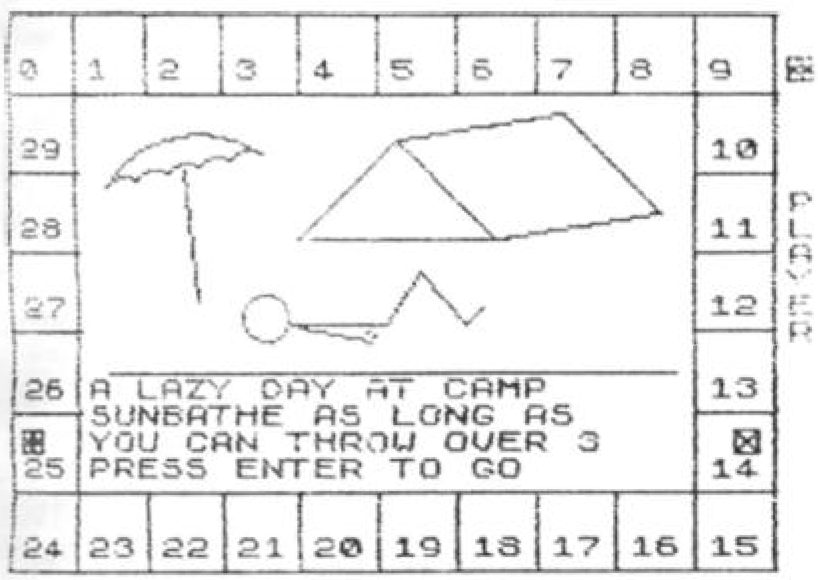
(x) will be one or two according to value of PL.

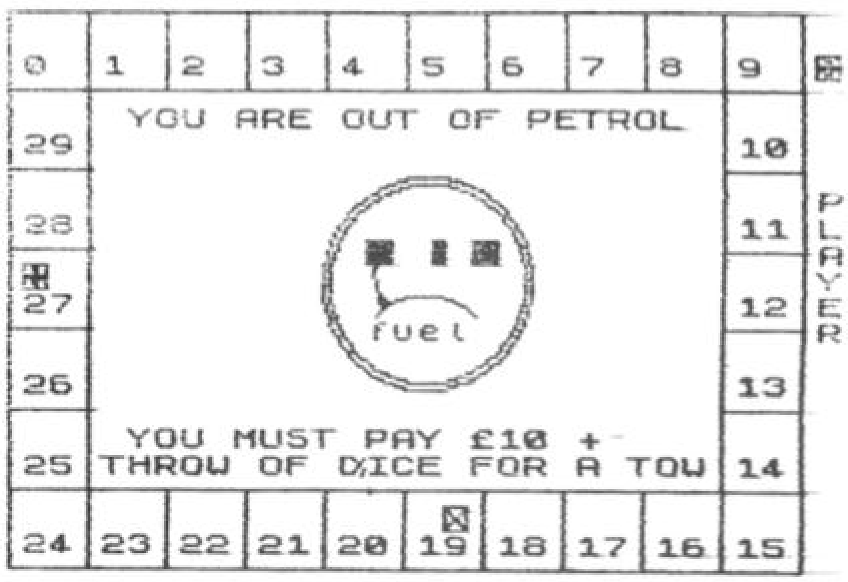
The subroutines use many more variables, but they are confined within those routines and are not difficult to trace through. There are also a number of DIMensioned strings and variables. These are used in several routines and are reDIMensioned each time that routine is called.

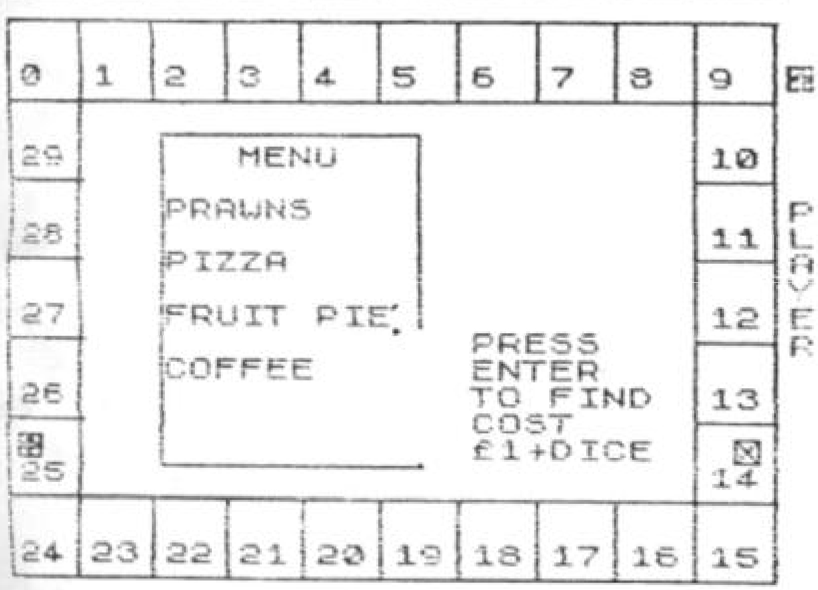
Some sample screen illustrations from the program, Tourist trap.

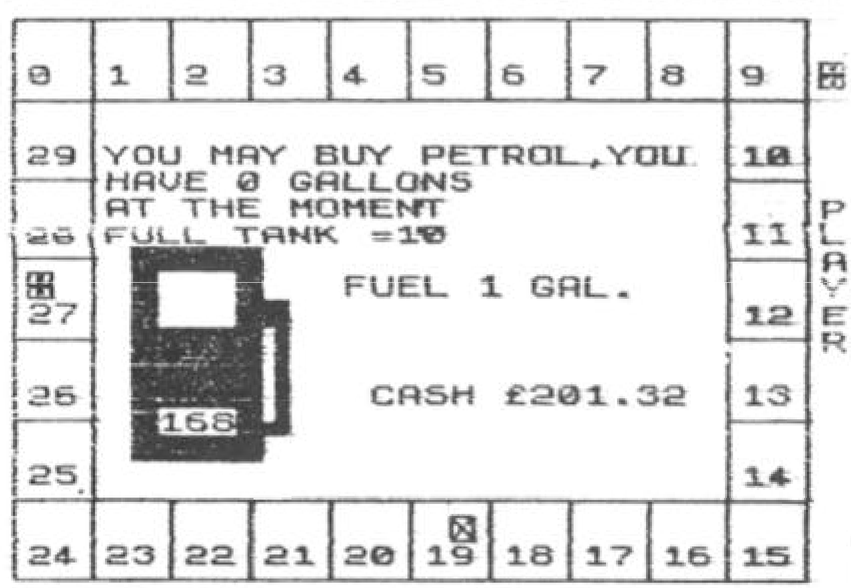


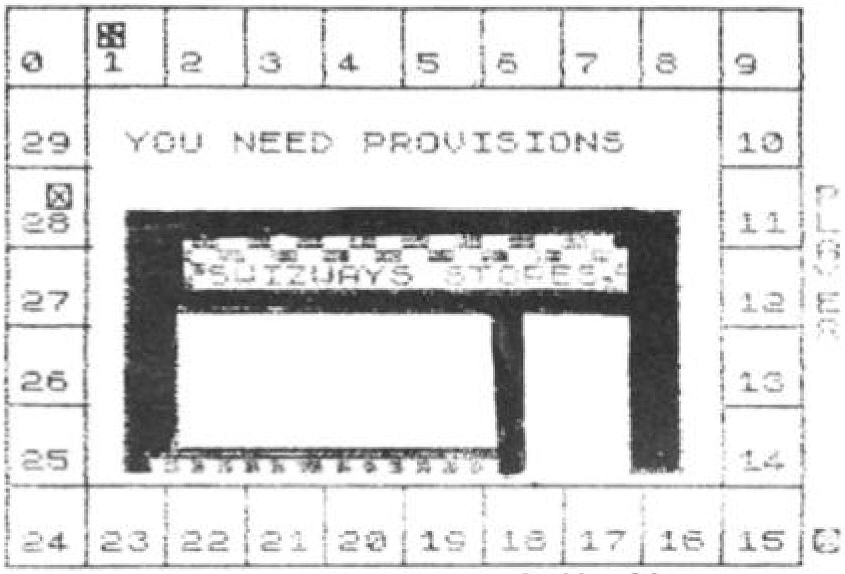


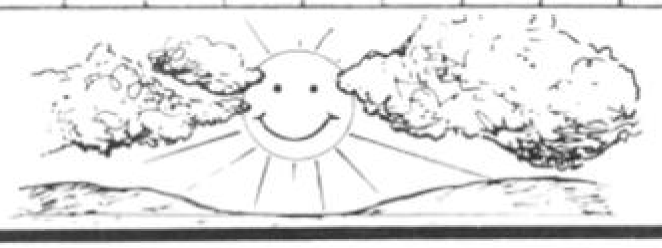












```
  10 REM ***********************
  11 REM *** TOURIST  TRAP ***
  12 REM ***********************
  19 REM ***    C.N.GOOCH    ***
  21 REM ***********************
  22 REM ***********************
  50 CLS : PRINT AT 10,5; PAPER 5;".STOP THE TAPE ": GO SUB 8650
  60 RANDOMIZE : CLS : PAPER 7: INK 0: CLS : GO SUB 9000: LET PL=1+INT (RND*2): BORDER PL: CLS : PRINT AT 12,6;"PLAYER "; INK PL;CHR$ (143+PL); INK 0;" TO START ": BEEP .7,20: GO SUB 8650: CLS : BORDER 0
  70 DIM V(2): DIM H(2): DIM J(2): DIM C(2): DIM P(2)
  80 FOR N=1 TO 2: LET J(N)=0: LET C(N)=250: LET P(N)=5: NEXT N
  90 LET FWD=2: LET FSF=0: LET TI=0: LET D=1
 100 LET V(1)=1: LET V(2)=1: LET H(1)=1: LET H(2)=2
 110 GO SUB 8000
 120 LET LO=0: GO SUB 6430: GO SUB 6500
 130 IF C(1)>0 AND C(2)>0 THEN GO TO 120
 140 GO SUB 8500: PRINT AT 7,11; INK 1; FLASH 1; BRIGHT 1;" GAME OVER";AT 10,6; PAPER 5; FLASH 0;"PLAYER "; INK 1+(C(2)<=0),CHR$ (144+(C(2)<=0)); INK 1;" OUT OF CASH";AT 14,5;"PRESS ENTER FOR SCORES": INPUT LINE Z$
 150 LET J(1)=J(1)+P(1): LET J(2)=J(2)+P(2): LET p(1)=0: LET p(2)=0: GO SUB 8600
 160 IF J(1)=J(2) THEN GO SUB 8500: PRINT AT 10,7;" GAME DRAWN ": GO SUB 8650: GO TO 190
 170 GO SUB 8500: PRINT AT 7,5;" PLAYER "; INK 1+(J(2)>J(1));CHR$ (144+(J(2)>J(1))); INK 0;" WINS "
 180 IF INKEY$<>"" THEN GO TO 180
 190 PRINT AT 11,5;" DO YOU WANT TO PLAY";AT 12,12;" AGAIN? ";AT 14,5;"PRESS YES OR NO ";AT 15,5;"OR DIFFERENT FOR ";AT 17,8;" A NEW GAME": IF INKEY$="Y" OR INKEY$="y" THEN RUN 60
 200 IF INKEY$="N" OR INKEY$="n" THEN GO SUB 8500: GO TO 230
 210 IF INKEY$="D" OR INKEY$="d" THEN CLS : PRINT AT 10,5; PAPER 5;"START THE TAPE": LOAD ""
 220 GO TO 190
 230 PRINT AT 10,7;"THANKS FOR PLAYING ";AT 11,10;"BYEEE": GO TO 230
1000 REM ### CHECK PETROL ###
1010 LET TI=TI+1: LET P(PL)=P(PL)-(INT (MI/.3))/100: IF P(PL)>0 THEN RETURN
1020 LET DTV=D: LET LO=1: LET P(PL)=0: GO SUB 8500: CIRCLE 130,90,32: CIRCLE 130,90,30: PLOT 115,80: DRAW 30,0,-.5*PI: PLOT 117,82: DRAW -5,20: PRINT AT 12,14;"fuel";AT 9,14; INK 2;"▒    ";AT 9,16; INK 1;"▌▒"
1030 PRINT AT 4,4;" YOU ARE OUT OF PETROL "
1040 PRINT AT 16,4;" YOU MUST PAY £10 +   ";AT 17,4;"THROW OF DICE FOR A TOW": PAUSE 250: GO SUB 6430: LET C(PL)=C(PL)-(10+D):
1050 LET J(PL)=J(PL)-5*(TI=1)-2*(TI=2): GO SUB 8610
1060 GO SUB 8650: GO SUB 8500: IF TI=1 THEN PRINT AT 10,4;" DAY RUINED ";AT 11,4;" LOSE 5 POINTS ";AT 12,4;" SCORE NOW ";J(PL)
1070 PRINT AT 16,4;" YOU HAVE TO PAY £";10+D;"    ";AT 17,4;" TOTAL CASH NOW ";C(PL);" ": IF TI=2 THEN PRINT AT 10,4;" LOSE 2 POINTS  ";AT 11,4;" SCORE NOW ";J(PL)
1080 GO SUB 8650
1090 GO SUB 8500: GO SUB 4360: LET D=DTV: RETURN
2090 REM ### RESTAURANT ###
2100 GO SUB 8650: GO SUB 8500: PRINT AT 5,5;" GO OUT FOR A MEAL. ";AT 6,10;" INSTEAD ";AT 10,6; INK 7; PAPER 1; BRIGHT 1;" BURPIOS          ";AT 11,6;" Italian Restaurant": GO SUB 8650
2110 GO SUB 8500: PLOT 55,138: DRAW 81,0: DRAW 0,-100: DRAW -81,0: DRAW 0,100
2120 LET SCM=0: DIM T$(8,10)
2130 DATA "OYSTERS","PRAWNS","MELON","SOUP"
2140 DATA "FISH","CHICKEN","STEAK","PIZZA"
2150 DATA "ICE CREAM","GATEAUX","FRUIT PIE","PANCAKES"
2160 DATA "SQUASH","TEA","COFFEE","COKE"
2170 FOR M=10 TO 40 STEP 10: LET NN=1+INT (RND*4): RESTORE (2120+M): FOR N=1 TO NN: READ T$(M/10): NEXT N: LET SCM=SCM+NN: NEXT M
2180 FOR N=5 TO 16: PRINT AT N,7;T$(5): NEXT N: PRINT AT 5,9; PAPER 3; INK 7; BRIGHT 1;" MENU "
2190 FOR N=7 TO 13 STEP 2: PAUSE 25: BEEP .02,N: PRINT AT N,7;T$((N-5)/2): NEXT N
2200 LET T$(6)="YUK !!": LET T$(7)="NOT BAD": LET T$(8)="YUMMY"
2210 PAUSE 70: PRINT AT 12,17; PAPER 5;"MEAL WAS   ";AT 13,17;T$(6+(SCM>8)+(SCM>11)): BEEP .4,1-20*(SCM<9)+20*(SCM>11): PRINT AT 14,17;"SCORE ";INT (SCM/2): LET J(PL)=J(PL)+INT (SCM/2)
2220 GO SUB 8650: PRINT AT 12,17; PAPER 4;"  PRESS   ";AT 13,17;"  ENTER   ";AT 14,17;"  TO FIND ";AT 15,17;"  COST    ";AT 16,17;"  £1+DICE "
2230 IF INKEY$<>"" THEN GO TO 2230
```

```
2240 GO SUB 8650: GO SUB 8500: G
O SUB 8430: LET C(PL)=C(PL)-1-D:
 PRINT AT 14,6;" MEAL COST £";1+
D
2250 IF SCH>11 AND (1+D)<3 THEN
PRINT AT 16,6;" GOOD & CHEAP ";A
T 17,6;" BONUS SCORE 2 ": LET J(
PL)=J(PL)+2
2260 RETURN
3940 REM ### CASTLE ###
3950 GO SUB 3960: GO SUB 3990: R
ETURN
3960 PRINT AT 5,5; PAPER 6;"
         ";AT 6,5;"
         ";AT 7,5;"
         "
3970 FOR N=1 TO 8: PRINT AT N+7,
5; PAPER 6;"
 ": NEXT N: FOR N=11 TO 15: PRI
NT AT N,14; PAPER 7;"     ": NEX
T N
3980 PRINT AT 10,6; PAPER 2; INK
 7; BRIGHT 1;"CRUMBLY";AT 11,7;"
CASTLE": RETURN
3990 LET MI=15+INT (RND*15): PRI
NT AT 17,4; PAPER 5;"A JOURNEY O
F ";MI;" MILES";AT 14,20; PAPER
4;"ENTRY";AT 15,20;" £1.50 "
4000 INPUT "DO YOU WANT TO GO YE
S OR NO?"; LINE Z$: IF Z$="N" OR
 Z$="n" THEN RETURN
4010 GO SUB 1000: IF LO=1 THEN L
ET TI=0: RETURN
4015 IF 1+INT (RND*14)=1 THEN PA
USE 50: PRINT AT 14,20;"CLOSED";
AT 15,20;"TODAY  ": LET J(PL)=J(
PL)-5: PRINT AT 16,4; PAPER 4;"D
ISAPPOINTED!";AT 17,4;" LOSE 5 P
OINTS          ": FOR N=10 TO 1 ST
EP -1: BEEP .3,N: NEXT N: GO SUB
 8650: GO SUB 1000: LET TI=0: GO
 TO 8600: RETURN
4020 LET C(PL)=C(PL)-1.5: RESTOR
E 4030: DIM H$(6,11)
4030 DATA "BORING","VERY DULL","
BEARABLE","FASCINATING","EXCITIN
G","FABULOUS"
4040 FOR N=1 TO 6: BEEP .1,N: RE
AD Q$: LET H$(N)=Q$: NEXT N: PRI
NT AT 4,4; PAPER 5;"THROW DICE T
O SEE IF IT";AT 5,4;"IS INTEREST
ING"
4050 GO SUB 8650: FOR N=1 TO 200
: NEXT N: IF INKEY$<>"" THEN GO
TO 4050
4060 GO SUB 8500: GO SUB 8430: F
OR n=1 TO 300: NEXT n: GO SUB 39
50: PRINT AT 4,4; PAPER 4;"IT IS
 ";H$(D);AT 5,4;" SCORE ";D: LET
 J(PL)=J(PL)+D: LET FC=1: GO TO
4080
4070 GO SUB 8650: PRINT AT 4,4;
PAPER 6;"                        "
;AT 5,4;"                 ": RETURN
4080 IF RND<.2 THEN GO SUB 4070:
 PRINT AT 4,4;"YOU SEE THE GHAST
LY      ": PAUSE 50: PRINT AT 5,4;
 FLASH 1; PAPER 3;" GHOST "; FLA
SH 0; PAPER 6;"  SCORE 5        "
: GO SUB 4130: LET J(PL)=J(PL)+5
: LET FC=0
4090 IF RND<.3 THEN GO SUB 4070:
 PRINT AT 4,4;"GOOD PHOTOS FROM
TOWER ";AT 5,4;"SCORE 3
         ": LET J(PL)=J(PL)+3: LET
 FC=0
4095 IF RND<.25 THEN GO SUB 4070
: PRINT AT 4,4; PAPER 3; INK 7;
BRIGHT 1;"YOU GET LOST IN THE
 ";AT 5,4;"DUNGEON,  LOSE 4 POIN
TS": LET J(PL)=J(PL)-4: LET FC=0
4100 IF RND<.3 THEN GO SUB 4070:
 PRINT AT 4,4; PAPER 4;" SMASHIN
G CREAM TEA !  ";AT 5,4;"SCORE 4
                 ": LET J(PL)=J(P
L)+4: LET FC=0
4110 IF FC THEN GO TO 4080
4120 GO SUB 8650: GO SUB 8500: G
O SUB 1000: LET TI=0: GO SUB 860
0: RETURN
4130 FOR N=1 TO 10
4140 PRINT AT 10,20; OVER 1; PAP
ER 7; INK 0;"E"
4145 PRINT AT 11,20; OVER 1; PAP
ER 7; INK 0;"HI"
4150 PRINT AT 12,20; OVER 1; PAP
ER 7; INK 0;"LL"
4160 PAUSE 20: NEXT N: RETURN
4340 REM ### BUY PETROL ###
4350 IF P(PL)>=7 OR RND<.5 OR LO
 THEN GO TO 4497
4360 GO SUB 8610: IF P(PL)<=0 AN
D C(PL)<=0 THEN GO TO 140
4365 PRINT AT 5,4;"YOU MAY BUY P
ETROL,YOU ";AT 6,4;"HAVE ";P(PL)
;" GALLONS  ";AT 7,4;"AT THE MOM
ENT ";AT 8,4;"FULL TANK =10 ";AT
 14,13;" CASH £";C(PL);" "
4370 DIM H$(5,6)
4380 LET H$(1)="      "
4390 LET H$(2)="      "
4400 LET H$(3)="      "
4410 LET H$(4)="      "
4420 LET H$(5)="      "
4430 DATA 1,2,3,4,4,4,5,1
4440 RESTORE 4430: FOR N=1 TO 8:
 READ A: PRINT AT 8+N,5;H$(A): N
EXT N: LET PR=160+INT (RND*10):
PRINT AT 15,6;PR
4445 INPUT "ENTER GALLONS TO BE
BOUGHT"; LINE R$: IF CODE R$<48
OR CODE R$>58 THEN GO TO 4445
4450 LET GA=VAL R$: IF GA*(PR/10
0)>C(PL) THEN LET GA=C(PL)/(PR/1
00): LET P(PL)=P(PL)+GA: LET C(P
L)=0: GO SUB 8610: PRINT AT 9,13
;"CASH FOR ONLY";AT 10,13;(INT G
A*100)/100;" GAL.";AT 14,20;"
 ": GO TO 4470
4454 IF P(PL)+GA>10 THEN GO TO 4
445
4455 IF P(PL)+GA<=10 THEN LET P(
PL)=P(PL)+GA: LET C(PL)=C(PL)-GA
*(PR/100)
4465 GO SUB 8610: PRINT AT 10,13
;"FUEL ";P(PL);" GAL.";AT 14,13;
" CASH £";C(PL)
4470 GO SUB 8650: GO SUB 8500
4490 IF LO OR RND>.5 THEN RETURN

4495 REM ##### SITE FEES #####
4497 IF FSF=1 THEN GO TO 4550
4500 FOR N=5 TO 7: PRINT AT N,6;
"                  ": NEXT N: PR
INT AT 6,7; PAPER 4;" A CAMPING
SITE "
4510 LET SF=3+INT (RND*3): PRINT
 AT 8,4;"YOU MUST PAY SITE FEES
";AT 9,4;"  PRESS ENTER TO FIND
 ";AT 10,13;"  COST  ";AT 13,4;"
 COST WILL BE £";SF;" TIMES ";AT
 14,4;" THROW OF DICE            "
4515 PAUSE 0: BEEP .2,20: FOR N=
1 TO 150: NEXT N: IF INKEY$<>""
THEN GO TO 4500
4520 GO SUB 8500: GO SUB 8430: P
RINT AT 11,4;"  COST IS  £";SF*D
;"           ": LET C(PL)=C(PL)-(SF
*D)
4530 DIM N$(3,8): LET N$(1)="TER
RIBLE": LET N$(2)="GOOD": LET N$
(3)="PRETTY": LET ST=1+INT (RND*
3)
4540 PAUSE 100: LET J(PL)=J(PL)+
(ST=3)+(ST=2 OR ST=3)-(ST=1): PR
INT AT 15,4;"IT IS A ";N$(ST);"
 SITE ";AT 16,4;"SCORE ";(ST=3)+
(ST=2 OR ST=3)-(ST=1): LET FSF=1
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: GO SUB 8650: GO TO 8600
4550 GO SUB 4555: GO TO 4590
4555 GO SUB 8500: FOR N=8 TO 11: PRINT AT N,5; INK 3;"████████████████████": NEXT N: FOR N=9 TO 10: PRINT AT N,7; INK 1;"▄▀▄▀▄▀▄▀▄▀▄▀▄▀▄▀": NEXT N
4560 PRINT AT 10,8; PAPER 7; INK 2; BRIGHT 1;"SWIZWAYS STORES"
4570 FOR N=12 TO 17: PRINT AT N,5; INK 3;"██             █    ██": NEXT N
4580 PRINT AT 17,5; INK 1; PAPER 3;"████████████████": RETURN
4590 PRINT AT 5,5;"YOU NEED PROVISIONS": GO SUB 8650
4600 PRINT AT 6,5; PAPER 4;"DICE WILL DECIDE WHAT";AT 7,5;"HAPPENS. IN STORE": GO SUB 8650: GO SUB 8500: GO SUB 8430
4610 RESTORE 4610: DATA "OUTRAGEOUS","EXPENSIVE","AVERAGE","FAIRLY CHEAP","VERY CHEAP","GIVE AWAY"
4620 FOR N=1 TO D: READ Q$: NEXT N: LET DV=D: PRINT AT 12,4;"THE PRICES IN THE SHOP ";AT 13,4;"ARE ";Q$
4630 PRINT AT 15,5;" SCORE ";D: LET J(PL)=J(PL)+D: GO SUB 8650
4640 GO SUB 8500: LET PR=12+INT (RND*5): PRINT AT 12,4;"YOU EXPECT TO SPEND £";PR;AT 13,4;"DICE WILL TELL YOU ";AT 14,4;"SIZE OF BILL ": PAUSE 90: GO SUB 8430
4650 LET PP=5+D*3: PRINT AT 13,4;"YOU ACTUALLY SPEND £";PP;AT 14,4; PAPER 6;"                    "
4660 LET C(PL)=C(PL)-PP
4670 IF PP<PR-2 THEN PRINT AT 16,4;"YOU SAVE MONEY ": IF DV=1 OR DV=2 THEN PRINT AT 16,19;"ALTHOUGH";AT 17,4;"IT IS ";Q$;"  "
4680 IF PP<PR-2 THEN PRINT AT 17,20;"SCORE ";3+3*(DV<3): LET J(PL)=J(PL)+3+3*(DV<3): GO TO 4720
4690 IF PP>PR+2 THEN PRINT AT 16,4;"YOU OVER SPEND ": IF DV>4 THEN PRINT AT 16,19;"ALTHOUGH";AT 17,4;"IT'S ";Q$;"  "
4700 IF PP>PR+2 THEN PRINT AT 17,20;"SCORE";-3-3*(DV>4): LET J(PL)=J(PL)-3-3*(DV>4): GO TO 4720
4710 PRINT AT 16,4;"YOU ARE CLOSE TO YOUR ";AT 17,4;"BUDGET. SCORE 2": LET J(PL)=J(PL)+2
4720 LET FSF=0: GO SUB 8650: GO TO 8600
4740 REM #### LAZY DAY ####
4750 LET SCD=0: PLOT 39,120: DRAW 50,10,-.5*PI: FOR N=1 TO 5: DRAW -10,-2,.5*PI: NEXT N: PLOT 64,125: DRAW 5,-40: PLOT 39,64: DRAW 175,0: PLOT 100,104: DRAW 30,30: DRAW 30,-30: PLOT 130,134: DRAW 50,8: DRAW 30,-30: DRAW -50,-3: DRAW -56,0
4760 CIRCLE 90,80,7: DRAW 30,0: DRAW 10,16: DRAW 14,-16: DRAW 5,5: PLOT 100,77: DRAW 22,-4: PRINT AT 14,4;"A LAZY DAY AT CAMP"
4770 PRINT AT 15;4;"SUNBATHE AS LONG AS";AT 16,4;"YOU CAN THROW OVER 3";AT 17,4; PAPER 4;"PRESS ENTER TO GO": PAUSE 0: GO SUB 8430: PRINT AT 10,20; FLASH 1;;"AGAIN": LET J(PL)=J(PL)+D: LET SCD=SCD+D: IF D>3 THEN GO TO 4770
4780 PRINT AT 10,12; PAPER 5;"SUN'S GONE IN": FOR N=0 TO -10 STEP -1: BEEP .05,N: NEXT N: IF SCD<=8 THEN GO SUB 2000
4790 GO SUB 8650: GO SUB 8500: GO TO 8600
4795 REM #### GOLF ####
4800 GO SUB 4810: GO SUB 4860: RETURN
4810 FOR N=4 TO 9: PRINT AT N,4; PAPER 5;"                          ": NEXT N
4820 FOR N=10 TO 17: PRINT AT N,4; PAPER 4;"                          ": NEXT N
4830 PRINT AT 12,6; PAPER 4; INK 6;"DEG"
4835 PRINT AT 13,6; PAPER 4; INK 6;"H█I"
4840 PRINT AT 14,6; PAPER 4; INK 6;"JKM"
4850 PLOT 180,120: DRAW 0,-24: PRINT AT 7,23;"1": RETURN
4860 PRINT AT 6,6;" A DAY AT ";AT 7,6;" THE GOLF CLUB ": PAUSE 75: PRINT AT 12,12;" YOU PLAY YOUR ";AT 13,12;" OPPONENT IN ";AT 14,12;" THIS GAME "
4870 GO SUB 8650: GO SUB 4810: PRINT AT 6,6;"LOSER OF GAME";AT 7,6;" PAYS FOR";AT 8,6 ;"THE GAME, COST £10";AT 9,6;"WINNER GETS 10 POINTS"
4880 DIM S(2,18)
4890 GO SUB 8650: GO SUB 8500: PRINT AT 10,5;"PLAYER "; INK 1;"A","PLAYER "; INK 2;"B";AT 4,4;"HOLD ""S"" TO SPEED GAME "
4900 DATA 2,3,4,3,4,2,3,3,4,4,2,3,5,4,3,2,4,3
4910 LET DR=0: LET GSA=0: LET GSB=0: RESTORE 4900: LET HOL=1+INT (RND*80): FOR N=1 TO 18
4920 READ P: PRINT AT 6,6;"HOLE NUMBER ";N;AT 7,6;"PAR = ";P+1
4930 LET S(1,N)=P+INT (RND*3)
4940 LET S(2,N)=P+INT (RND*3)
4950 LET GSA=GSA+S(1,N): LET GSB=GSB+S(2,N)
4960 PRINT AT 12,7;S(1,N);AT 12,17;S(2,N);AT 15,7;GSA;AT 15,17;GSB
4970 IF GSA=HOL AND DR=0 THEN PRINT AT 12,7;"1": FOR M=1 TO 40 STEP 4: BEEP .4,M: PRINT AT 17,4; FLASH 1;"HOLE IN ONE PLAYER "; INK 1;"A": NEXT M: LET GSA=GSA-S(1,N)+1: LET DR=1: PRINT AT 17,4; PAPER 6;"                          "
4980 IF GSB=HOL AND DR=0 THEN PRINT AT 12,17;"1": FOR M=1 TO 40 STEP 4: BEEP .4,M: PRINT AT 17,4; FLASH 1;"HOLE IN ONE PLAYER "; INK 2;"B": NEXT M: LET GSB=GSB-S(2,N)+1: LET DR=2: PRINT AT 17,4; PAPER 6;"                          "
4990 PAUSE 150: BEEP .5,20: NEXT N: PAUSE 50: GO SUB 4810
4995 IF GSA=GSB THEN PAUSE 100: PRINT AT 5,4;"GAME DRAWN. ";AT 6,4;"SHARE COST AND POINTS": LET J(1)=J(1)+5: LET J(2)=J(2)+5: LET C(1)=C(1)-5: LET C(2)=C(2)-5
5000 IF GSA>GSB THEN LET J(2)=J(2)+10: LET C(1)=C(1)-10: PRINT AT 5,4;"PLAYER "; INK 2;"B"; INK 0;" WINS"
5010 IF GSA<GSB THEN LET J(1)=J(1)+10: LET C(2)=C(2)-10: PRINT AT 5,4;"PLAYER "; INK 1;"A"; INK 0;" WINS"
5015 IF DR=0 THEN GO TO 5060
5020 IF DR=1 THEN PRINT AT 7,4;"PLAYER "; INK 1;"A"; INK 0;" HAD ";AT 8,4;"A HOLE IN ONE"
5030 IF DR=2 THEN PRINT AT 7,4;"PLAYER "; INK 2;"B"; INK 0;" HAD ";AT 8,4;"A HOLE IN ONE"
5040 GO SUB 8650: GO SUB 4810: IF DR>0 THEN PRINT AT 10,10;"A ROUND AT 19th";AT 11,10;"TEE WILL
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COST :";AT 12,10;"£2xTHROW OF DI
CE": PAUSE 200: GO SUB 8430
5050 IF DR>0 THEN LET C(DR)=C(DR
)-2*D: PRINT AT 17,5;"COST £";2*
D
5060 GO SUB 8650
5070 GO TO 8600
5150 REM #### BEACH TRIP
 ####
5160 LET D=6: GO SUB 5170: GO TO
 5230
5170 LET SUB=5170: FOR N=4 TO 10
: PRINT AT N,4; PAPER 5;"
                 ": NEXT N: FOR N
=11 TO 12: PRINT AT N,4; PAPER 1
;"                         ": NEXT
 N
5180 IF D>=4 THEN FOR N=1 TO 10:
 INK 6: PAPER 5: CIRCLE 160,120,
N: NEXT N: INK 0: PAPER 7
5190 IF D<=3 THEN PRINT AT 6,18;
 PAPER 5; INK 7;"DEFEFEFG";AT 7,
18;"H       I";AT 8,18;"H       I"
;AT 9,18;"JKLKLKLM"
5200 IF D<=2 THEN FOR N=10 TO 16
 STEP 2: FOR M=11 TO 17 STEP 2:
PRINT AT N,18;" ' ' ' ' ";AT M,1
8;" ' ' ' ' ": NEXT M: NEXT N
5210 IF D=1 THEN PLOT 180,90: IN
K 5: BRIGHT 1: DRAW -5,-10: DRAW
 3,0: DRAW -5,-15: INK 0: BRIGHT
 0
5220 RETURN
5230 FOR N=13 TO 17: PRINT AT N,
14; PAPER 7; INK 3;"       ":
 NEXT N: PRINT AT 9,5;" A TRIP T
O BEACHY BAY";AT 13,14; INK 3;"
   ";AT 17,14;"
;AT 14,15; INK 1;"CAR PARK";AT 1
5,17;"£1";AT 16,15;"A DAY": GO S
UB 8650
5235 FOR N=13 TO 17: PRINT AT N,
14; PAPER 6;"          ": NEXT N
5240 LET MI=20+INT (RND*10): PRI
NT AT 13,5;"YOU MAY GO ON A VISI
T";AT 14,5;" TO THE SEA ";AT 15,
5;" IT IS ";MI;" MILES ": INPUT
" ENTER "; FLASH 1;"Y"; FLASH 0;
"ES OR "; FLASH 1;"N"; FLASH 0;"
O"; LINE Z$: IF Z$="N" THEN RETU
RN
5245 GO SUB 1000: IF LO=1 THEN L
ET TI=0: RETURN
5250 LET C(PL)=C(PL)-1: LET LO=0
: GO SUB 8500: PRINT AT 10,5;" T
HROW DICE TO FIND   ";AT 11,5;" O
UT THE WEATHER.     ";AT 12,5;" T
HE HIGHER SCORE     ";AT 13,5;" T
HE BETTER           "
5260 GO SUB 8430: DIM H$(6,6)
5270 LET H$(1)="STORMY": LET H$(
2)="RAINY": LET H$(3)="CLOUDY":
LET H$(4)="WARM": LET H$(5)="HOT
": LET H$(6)="SUPER"
5280 PAUSE 25: GO SUB 8500: GO S
UB SUB: LET J(PL)=J(PL)+D: PRINT
 AT 10,5;" THE WEATHER IS ": PAU
SE 50: PRINT AT 11,5;H$(D);" SCO
RE ";D
5290 IF SUB<>5170 THEN RETURN
5300 IF D>2 AND RND<.6 THEN GO S
UB 8650: PRINT AT 5,4;"YOU WIN A
";AT 6,4;"SANDCASTLE";AT 7,4;"CO
MPETITION": LET PRI=2+INT (RND*4
): PRINT AT 8,4;"SCORE ";PRI;" P
OINTS": LET J(PL)=J(PL)+PRI
5305 IF D>2 THEN GO TO 5580
5310 PAUSE 70: PRINT AT 5,4;" GO
 ON THE ";AT 6,4;" PIER OUT OF";
AT 7,4;" THE RAIN": GO SUB 8650
5320 GO SUB 8500: FOR N=5 TO 17
STEP 2: PRINT AT N,4+INT N/2; PA
PER 1+INT (RND*5); INK 9; FLASH
INT (RND*2); BRIGHT INT (RND*2);
"PENNY ARCADE": FOR M=1 TO 50 ST
EP 7:
BEEP .2-N/100,M: NEXT M: N
EXT N
5330 DIM J$(11,13): PAUSE 30: GO
 SUB 8500: PRINT AT 5,5; PAPER 5
;" FRUIT MACHINE "
5340 LET J$(1)="             "
5345 LET J$(2)="             "
5350 LET J$(4)="             "
5355 LET J$(9)="             "
5360 LET J$(3)=J$(2): LET J$(5)=
J$(4): LET J$(6)=J$(4): LET J$(7
)=J$(2): LET J$(8)=J$(2): LET J$
(10)=J$(2): LET J$(11)=J$(4)
5370 FOR N=1 TO 11: PRINT AT 6+N
,6; PAPER 7;J$(N): NEXT N: FOR N
=10 TO 15: PRINT AT N,20; PAPER
6;" ": NEXT N: PRINT AT 15,19; P
APER 6;" "
5380 PRINT AT 6,21; PAPER 4;"POI
NTS";AT 8,23; PAPER 7;" 2 ";AT 9
,23;" --A"
5390 PRINT AT 11,23;" 4 ";AT 12,
23;"-BB";AT 14,23;" 8 ";AT 15,23
;"CCC"
5400 LET WT=0: LET TU=1: LET GO=
3+INT (RND*3): PRINT AT 17,8; PA
PER 2; INK 7; BRIGHT 1;"10p A GO
";AT 10,8; PAPER 1;"YOU HAVE";
AT 11,8;"  ";GO;" GOES ";AT 12,8
;"          "
5410 INPUT "PRESS ENTER TO PLAY
"; LINE Z$: LET W=0
5420 PRINT AT 7,8; PAPER 3; INK
7; BRIGHT 1;"GO ";AT 7,14;" ";TU
;"  "
5430 LET NN=20+INT (RND*10): FOR
 N=1 TO NN: LET FMA=(144+INT (RN
D*3)): LET FMB=(144+INT (RND*3))
: LET FMC=(144+INT (RND*3))
5440 FOR M=10 TO 12: PRINT AT M,
8; PAPER 5;"        ": NEXT M
5450 PRINT AT 11,9; INK 3;CHR$ F
MA;AT 11,12; INK 1;CHR$ FMB;AT 1
1,15; INK 2;CHR$ FMC: NEXT N
5460 IF FMC=144 THEN LET W=2
5470 IF FMB=145 AND FMC=145 THEN
 LET W=4
5480 IF FMA=146 AND FMB=146 AND
FMC=146 THEN LET W=8
5490 PRINT AT 15,12;W: LET TU=TU
+1: LET WT=WT+W: IF TU<>GO+1 THE
N BEEP .5,TU: GO TO 5410
5500 GO SUB 8650: GO SUB 8500: P
RINT AT 6,5;" YOU SCORED ";WT;"
POINTS ";AT 8,5;" IT COST YOU £"
;GO/10: LET J(PL)=J(PL)+WT: LET
C(PL)=C(PL)-(GO/10)
5590 GO SUB 8650: GO SUB 1000: L
ET TI=0: GO TO 8600
5600 REM ##### RAILWAY #####
5610 LET DSL=0: GO SUB 5620: GO
TO 5700
5620 DIM J$(6,17)
5630 LET J$(1)="                 "
5635 LET J$(2)="                 "
5640 LET J$(3)="                 "
5645 LET J$(4)="                 "
5650 LET J$(5)="                 "
5655 LET J$(6)="                 "
5660 FOR N=1 TO 6: PRINT AT 8+N,
5; PAPER 6;J$(N): NEXT N
5670 FOR N=5 TO 13: CIRCLE 80,54
,N: CIRCLE 120,54,N: NEXT N: FOR
 N=50 TO 53: PLOT 75,N: DRAW 56,
0: NEXT N
5680 PRINT AT 17,4; PAPER 6;"
                          "
5690 FOR N=7 TO 17: PRINT AT N,2
6;" ": NEXT N: PRINT AT 8,22; IN
K 2;" "; INK 7;" "; INK 2;"  ":
RETURN
5700 PRINT AT 5,8;" THE FULL O T
YN ";AT 6,11;" RAILWAY ": GO SUB
 8650: GO SUB 5710: GO TO 5720
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5710 FOR N=4 TO 6: PRINT AT N,4;
 PAPER 6;"
": NEXT N: RETURN
5720 LET MI=15+INT (RND*10): PRI
NT AT 5,5;"THE RAILWAY IS ";MI;A
T 6,10;" MILES AWAY";AT 16,18; P
APER 4;"COST £2": INPUT "DO YOU
WANT TO GO YES OR NO"; LINE Z$:
IF Z$="N" OR Z$="n" THEN RETURN
5730 GO SUB 1000: IF LO=1 THEN L
ET TI=0: RETURN
5740 LET C(PL)=C(PL)-2: IF RND>.
5 THEN GO TO 5760
5750 GO SUB 5710: PRINT AT 4,5;"
NO STEAM TRAINS TODAY";AT 5,5;"L
OSE 3 POINTS";AT 16,18; PAPER 6;
"          ": LET J(PL)=J(PL)-3
5760 GO SUB 8650: IF RND>.9 THEN
 GO SUB 5710: PRINT AT 4,5;"NEIT
HER ANY": LET DSL=1
5770 PRINT AT 5,5;"DIESELS RUNNI
NG TODAY";AT 6,5;"SCORE ";-3*(DS
L=1)+4*(DSL=0): LET J(PL)=J(PL)-
3*(DSL=1)+4*(DSL=0): GO TO 5790
5780 GO SUB 5710: PRINT AT 4,5;"
YOU'RE IN LUCK";AT 5,5;"STEAM TR
AINS RUNNING";AT 6,5;"TODAY. SCO
RE 5": LET J(PL)=J(PL)+5
5790 LET FL=1: IF RND<.8 THEN GO
 TO 5850
5800 GO SUB 8650: GO SUB 5710: P
RINT AT 4,10; PAPER 2; INK 7; FL
ASH 1; BRIGHT 1;" ACCIDENT "
5810 DIM S$(3,7): LET S$(3)="BRO
KEN": LET S$(2)="TWISTED": LET S
$(1)="GRAZED": LET Q=1+INT (RND*
3)
5820 PRINT AT 5,4;"YOU HAVE FALL
EN OFF THE";AT 6,4;"PLATFORM AND
 ";S$(Q);AT 7,10;"YOUR ANKLE": L
ET LG=3+2*(Q=2)+7*(Q=3)
5830 GO SUB 8650: GO SUB 5710: P
RINT AT 5,5;"LOSE ";LG;" POINTS
";AT 7,10; PAPER 6;"          "
 LET J(PL)=J(PL)-LG: LET FL=0
5850 IF RND>.5 THEN GO SUB 8650:
 GO SUB 5710: PRINT AT 5,5;" YOU
 SEE FAMOUS TRAIN ";AT 6,5;" SCO
RE 4 POINTS ": LET J(PL)=J(PL)+4
: LET FL=0
5860 IF RND>.92 THEN GO SUB 8650
: GO SUB 5710: PRINT AT 5,5;" YO
U GET A RIDE ON ";AT 6,5;" THE F
OOTPLATE ";AT 7,5;"SCORE 8 POINT
S ": LET J(PL)=J(PL)+8: LET FL=0
5870 IF FL THEN GO TO 5790
5900 GO SUB 8650: GO SUB 1000: L
ET TI=0: GO SUB 8600: RETURN
5990 REM ##### PARK #####
6000 LET MI=25+INT (RND*10): GO
SUB 6010: GO TO 6080
6010 DIM J$(9,16)
6020 LET J$(1)="
6025 LET J$(2)="
6030 LET J$(3)="
6035 LET J$(4)="
6040 LET J$(5)="
6045 LET J$(6)="
6050 LET J$(7)="
6055 LET J$(8)="
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6060 LET J$(9)=J$(8)
6070 LET SUB=6070: FOR N=1 TO 9:
 PRINT AT N+6,5;J$(N): NEXT N: P
RINT AT 4,5; PAPER 4;"     WILDWO
ODS     ";AT 5,5;"   SAFARI PARK
": RETURN
6080 PRINT AT 7,22; PAPER 5;"ENT
RY";AT 8,22;"£2.50";AT 17,4;"TO
GET THERE ";MI;" MILES"
6090 INPUT "WANT TO GO? YES OR N
O"; LINE Z$: IF Z$="N" OR Z$="n"
 THEN RETURN
6100 GO SUB 1000: IF LO=1 THEN L
ET TI=0: RETURN
6110 LET C(PL)=C(PL)-2.50: GO SU
B 6250
6120 DATA "LIONS","TIGERS","ELEP
HANTS","MONKEYS","GIRAFFES","RHI
NOS","CAMELS","BUFFALOS","WOLVES
","ZEBRAS","GNUS"
6130 LET AN=0: RESTORE 6120: GO
SUB 8650: GO SUB 8500: FOR N=1 T
O 11: READ Q$: IF RND<.3 THEN NE
XT N
6140 PRINT AT 7,5; PAPER 5;"IN T
HE ";AT 8,5;"RESERVE";AT 9,5;"YO
U SEE";AT 10,5;"THESE ";AT 11,5
;"ANIMALS";AT 13,5;"SCORE 2 ";AT
 14,5;"FOR EACH"
6150 IF N>4 AND FWD<0 AND 1+INT
(RND*50)<=5 THEN GO TO 6300
6160 PAUSE 80: PRINT AT N+5,15;Q
$: LET J(PL)=J(PL)+2: LET AN=AN+
2: PRINT AT 15,22;"SCORE";AT 16,
25;AN: NEXT N: PAUSE 100
6170 LET FL=1: GO SUB 8500: GO S
UB 6070
6180 IF RND>.8 THEN GO SUB 8650:
 PRINT AT 4,5,"YOU SLIP IN SEALI
ON ";AT 5,5;"POOL LOSE 3 POINTS
": LET J(PL)=J(PL)-3: LET FL=0
6190 IF RND>.6 THEN GO SUB 8650:
 PRINT AT 4,5;"HAVE SUPER ICE CR
EAM ";AT 5,5;"SCORE 2 POINTS
": LET J(PL)=J(PL)+2: LET FL=0
6200 IF RND>.7 THEN GO SUB 8650:
 PRINT AT 4,5;"GET STUNG BY A WA
SP ";AT 5,5;"LOSE 4 POINTS
": LET J(PL)=J(PL)-4: LET FL=0
6210 IF FL THEN GO TO 6180
6270 GO SUB 8650: GO SUB 1000: L
ET TI=0: LET FWD=FWD-1: GO TO 86
00
6300 FOR N=8 TO 13: PRINT AT N,4
; PAPER 2; INK 7; BRIGHT 1; FLAS
H 1;"                        ": N
EXT N
6310 PRINT AT 10,7; PAPER 1; INK
 7;" D I S A S T E R ": GO SUB
8650
6320 PRINT AT 9,4;" YOU BREAK DO
WN IN THE ";AT 10,4;"       RESE
RVE       ";AT 11,4;" PRESS EN
TER TO SEE HOW";AT 12,4;" MANY P
OINTS YOU LOSE "
6330 PAUSE 0: BEEP .05,0: FOR N=
1 TO 90: NEXT N: IF INKEY$<>"" T
HEN GO TO 6330
6340 GO SUB 8500: PRINT AT 15,8;
"LOSE 3+ DICE ": GO SUB 8430: PR
INT AT 15,8; PAPER 4;" LOSE ";3+
D;" POINTS": LET J(PL)=J(PL)-D-3
6350 GO SUB 8650: GO SUB 1000: L
ET TI=0: LET FWD=4: GO TO 8600
6490 REM #### MOVE PIECES ####
6500 IF INKEY$<>"" THEN GO TO 65
00
6510 PRINT AT V(PL),H(PL);" ": B
EEP .3,D: LET P(PL)=P(PL)-.25: I
F P(PL)<=.009 THEN GO SUB 1020:
LET 'O=0
6520 FOR N=1 TO D: IF V(PL)=1 TH
EN LET H(PL)=H(PL)+3: IF H(PL)>2
8+(PL=2) THEN LET V(PL)=V(PL)+(H
(PL)-(28+(PL=2))): LET H(PL)=28+
(PL=2): LET D=D-N: GO TO 6540
6530 NEXT N
6540 FOR N=1 TO D
6550 IF V(PL)>1 AND H(PL)=28+(PL
=2) THEN LET V(PL)=V(PL)+3: IF V
(PL)>19 THEN LET H(PL)=H(PL)-(V(
PL)-19): LET V(PL)=19: LET D=D-N
: GO TO 6570
6560 NEXT N
6570 FOR N=1 TO D
6580 IF V(PL)=19 AND H(PL)<28+(P
L=2) THEN LET H(PL)=H(PL)-3: IF
H(PL)<1+(PL=2) THEN LET V(PL)=V(
PL)+(-1+H(PL)-(PL=2)): LET H(PL)
=1+(PL=2): LET D=D-N: GO TO 6600
```

```
6590 NEXT N
6600 FOR N=1 TO D
6610 IF V(PL)<18 AND H(PL)=1+(PL=2) THEN LET V(PL)=V(PL)-3: IF V(PL)<1 THEN LET H(PL)=H(PL)+(1-V(PL)): LET V(PL)=1: LET D=D-N: GO TO 6500
6620 NEXT N
6630 PRINT AT V(PL),H(PL); INK PL;CHR$ (144+(PL=2))
6650 LET SUB=ATTR (V(PL)+1,H(PL)): IF SUB<>104 THEN GO SUB 8500: GO SUB SUB*50: LET LO=0
6660 LET PL=PL+(PL=1)-(PL=2): GO SUB 8500: GO SUB 8510: PRINT AT 2+18*(PL=2),31; INK 1+(PL=2);CHR$ (144+(PL=2)): RETURN
7990 REM ### SET UP BOARD ####
8000 DATA 4,28,148,172,4,28,244,220,5,0,5,0,5,0,4,0,5,0,5,0,2,7,5,0,5,0,4,7,5,0,5,0,5,0,5,0,2,7,5,0,5,0,6,0,5,0,5,0,5,0,2,7,1,7,5,0,3,7,5,0,5,0,7,0,2,7,5,0
8110 RESTORE 8000: FOR N=1 TO 4: READ A: PLOT 4,A: DRAW 240,0: NEXT N
8120 FOR Y=4 TO 172 STEP 24
8130 PLOT 4,Y: DRAW 25,0: PLOT 220,Y: DRAW 24,0: NEXT Y
8140 FOR N=1 TO 4: READ A: PLOT A,4: DRAW 0,168: NEXT N
8150 FOR X=4 TO 248 STEP 24
8160 PLOT X,4: DRAW 0,24: PLOT X,148: DRAW 0,24: NEXT X
8170 GO SUB 8500
8180 LET NA=0: LET    =34: LET NC=29: LET ND=5
8190 FOR L=1 TO 2: FOR N=1 TO 28 STEP 3: IF L=1 THEN READ A: READ B: PRINT AT 2,N; PAPER A; BRIGHT 1; INK B;NA;" "
8200 IF L=2 THEN READ A: READ B: PRINT AT 20,N; PAPER A; BRIGHT 1; INK B;NB
8210 LET NA=NA+1: LET NB=NB-1: NEXT N: NEXT L
8220 FOR L=1 TO 2: FOR N=5 TO 17 STEP 3: IF L=1 THEN READ A: READ B: PRINT AT N,1; BRIGHT 1; PAPER A; INK B;NC
8230 IF L=2 THEN READ A: READ B: PRINT AT N,28; PAPER A; BRIGHT 1; INK B;ND
8240 LET NC=NC-1: LET ND=ND+1: NEXT N: NEXT L
8250 GO SUB 8510
8260 PRINT AT 1,1; INK 1;"A";AT 1,2; INK 2;"B"
8270 PRINT AT 2+17*(PL=2),31; INK 1+(PL=2);CHR$ (144+(PL=2))
8300 REM #### DICE ####
8310 DIM A$(6,3): DIM B$(6,3): DIM C$(6,3)
8320 LET A$(1)="   "
8330 LET B$(1)=" C "
8340 LET C$(1)=A$(1)
8350 LET A$(2)="C  "
8360 LET B$(2)=A$(1)
8370 LET C$(2)="  C"
8380 LET A$(3)=A$(2): LET B$(3)=B$(1): LET C$(3)=C$(2)
8390 LET A$(4)="C C": LET B$(4)=A$(1): LET C$(4)=A$(4)
8400 LET A$(5)=A$(4): LET B$(5)=B$(1): LET C$(5)=A$(4)
8410 LET A$(6)="CCC": LET B$(6)=A$(1): LET C$(6)=A$(6)
8420 LET D$="▛▀▀▀▜": LET E$="▙▄▄▄▟": RETURN
8425 REM ###PRINT DICE ###
8430 LET D=1+INT (RND*6): PRINT AT 5,5;D$;AT 9,5;E$
8440 FOR N=6 TO 8: PRINT AT N,5;"▌";AT N,9;"▐": NEXT N
8450 PRINT AT 6,12;"PRESS ENTER TO";AT 7,12;" ""THROW"" DICE ";AT 8,11;" RELEASE TO STOP": INPUT LINE Z$
8460 IF D=7 THEN LET D=1
8470 PRINT AT 6,6;A$(D);AT 7,6;B$(D);AT 8,6;C$(D)
8480 IF INKEY$="" THEN RETURN
8490 LET D=D+1: GO TO 8460
8495 REM ### BLANK BOARD ###
8500 FOR Y=4 TO 17: PRINT AT Y,4; PAPER 6;"                        ": NEXT Y: RETURN
8505 REM ### BLANK LAST COL ###
8510 FOR N=0 TO 21: PRINT AT N,31; PAPER 0;" ": NEXT N
8520 DATA "P","L","A","Y","E","R"
8530 RESTORE 8520: FOR N=7 TO 12: READ R$: PRINT AT N,31; BRIGHT 1; PAPER 0; INK 6;R$: BEEP .005,N: NEXT N: RETURN
8590 REM ### DISPLAY SCORE ###
8600 GO SUB 8610: GO TO 8620
8610 LET P(PL)=(INT (P(PL)*100))/100: LET C(PL)=(INT (C(PL)*100))/100: RETURN
8620 GO SUB 8500: PRINT AT 6,6;"PLAYER "; INK 1;"A ";AT 8,6; INK 0;"SCORE NOW ";J(1);AT 9,6;"CASH NOW £";C(1);AT 10,6;"PETROL LEFT ";P(1);AT 12,6;"PLAYER "; INK 2;"B ";AT 14,6; INK 0;"SCORE NOW ";J(2);AT 15,6;"CASH NOW £";C(2);AT 16,6;"PETROL LEFT ";P(2)
8650 IF INKEY$<>"" THEN GO TO 8650
8660 INPUT "PRESS ENTER TO CONTINUE"; LINE Z$: BEEP .2,20: RETURN
9000 REM ###INSTRUCT ###
9010 PRINT AT 1,8; PAPER 2; INK 7; BRIGHT 1;" TOURIST TRAP ": GO SUB 9100: BORDER 4
9020 PRINT AT 3,2;" YOUR OBJECT IS TO SCORE AS "'" MANY POINTS AS POSSIBLE BEFORE"'" ONE OF THE PLAYERS RUNS OUT"'" OF MONEY."'"'"   YOU MOVE ROUND THE BOARD TO"'" THE THROW OF A DICE."'" YOU THROW RIGHT THROUGH YOUR"'" TURN EVEN IF DICE APPLIES TO"'" YOUR OPPONENT."
9030 PRINT AT 13,2;" IT IS AS WELL TO BUY PETROL"'" WHEN YOU CAN. ANY LEFT AT"'" THE END OF THE GAME WILL BE "'" CREDITED AS POINTS"
9040 PRINT AT 18,2;"PLAYER ONE HAS SYMBOL "; INK 1;"A"; INK 0;'"  PLAYER TWO HAS SYMBOL "; INK 2;"B"
9050 GO SUB 8650: RETURN
9100 REM ### GRAPHICS ###
9110 DATA 255,153,153,255,255,153,153,255,255,105,165,153,153,165,195,255,0,0,60,60,60,60,0,0
9120 DATA 0,0,0,0,5,15,7,15,0,12,28,125,255,255,255,255,0,0,0,0,193,231,239,255,0,0,0,0,192,192,224,240,15,15,31,63,127,63,63,15,240,224,252,252,248,240,224,240,15,15,3,1,0,0,0,0,255,255,255,255,124,60,24,16,255,255,223,135,6,4,0,0,240,224,224,128,0,0,0,0
9130 RESTORE 9110: FOR N=0 TO 12: FOR M=0 TO 7: BORDER M: BEEP .005,N
9140 READ A: POKE USR CHR$ (97+N)+M,A: NEXT M: NEXT N: RETURN
9900 SAVE "TOUR" LINE 10
9910 PRINT AT 10,2; PAPER 5;"REWIND TAPE.CHANGE PLUGS FOR"'" VERIFY. START THE TAPE "'" PRESS ENTER TO VERIFY "
9920 VERIFY "TOUR"
```

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TAPE 1: MATRIX OPERATIONS — **SPECTRUM £6.95 ZX81 £5.95**

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Side B: Determinants of square matrices

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Side B: Plot of integrals. Integration can be visualised on the screen

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Side B: Plot of bivariate regressions. You can see how your computer draws a best-fitting line on a set of numbered data points

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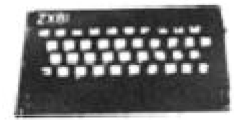
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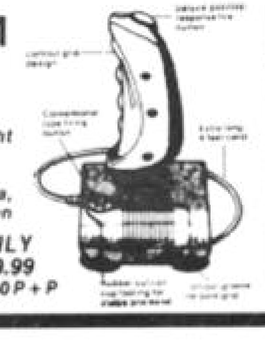
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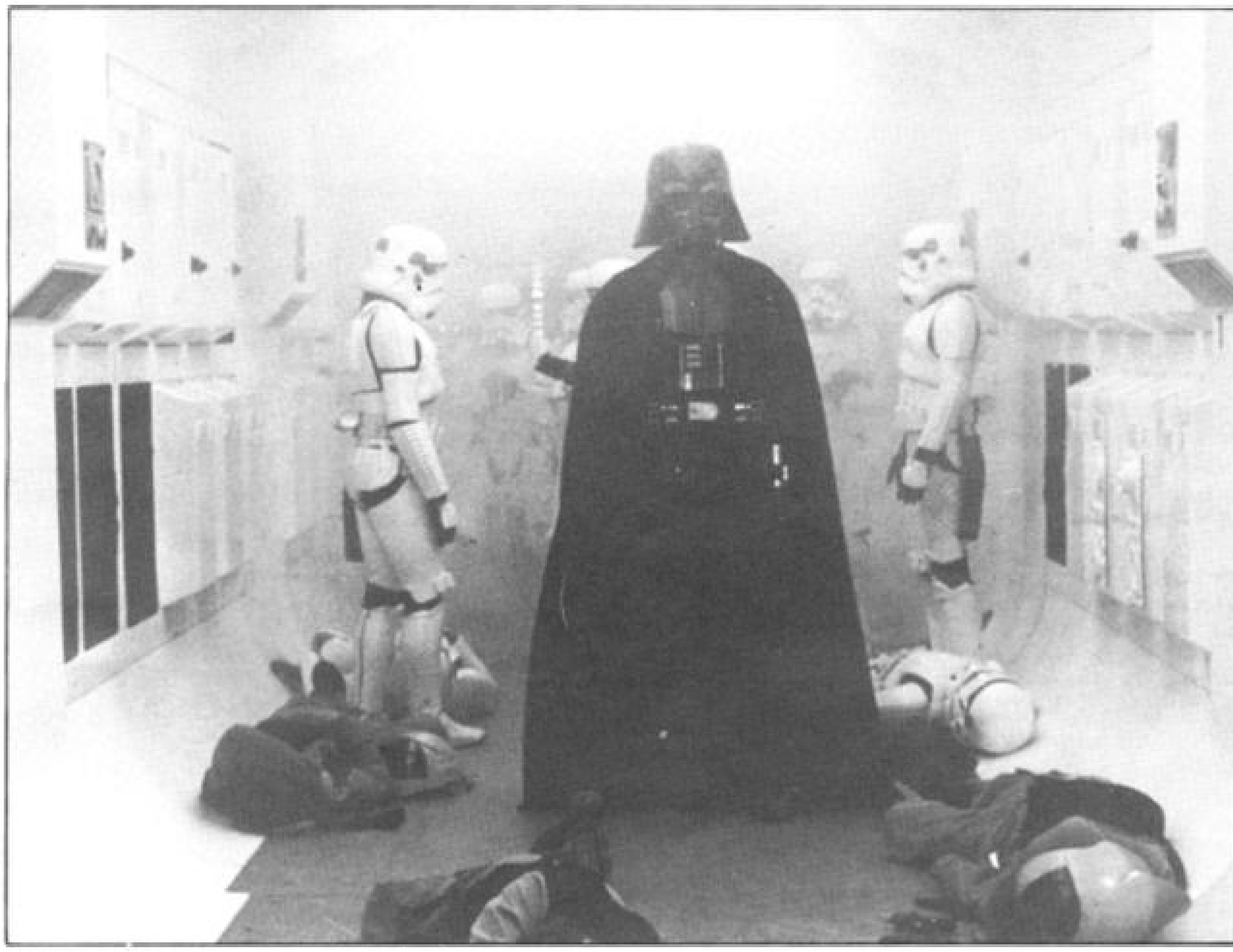
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The '81 soft selection

Nick Pearce casts his eyes over the latest software packages for the ZX81.



Invaders — Odyssey Computing

Invaders from Odyssey Computing is a high resolution — yes, high resolution on your ZX81 — version of the popular arcade game. Unbelievable? Well, its true, and no expensive hardware either, just the standard computer with 16K RAM. None of the usual ZX81 characters to represent the alien fleet, in this game they are the genuine article. Action is fast and smooth too, and the explosion when your ship is hit really is shattering!

After LOADing — which takes about five minutes — the program runs automatically. As well as the Hi-res display the facilities offered are impressive. The game required is first set up: a one or two player game can be selected (two players can either take turns or play simultaneously); the keyboard mode is selected; and the missile firing rate and bomb dropping rate are chosen. Selecting a high missile firing rate and a low bomb dropping rate gives a relatively easy game in which even the beginner can achieve a high score; increasing the bomb rate and/or reducing the missile firing rate makes the game more difficult for the experienced player.

The game is robust but will crash if, for example, invalid entries are made in the setting up sequence. A small price to pay for an excellent game.

I am afraid your existing library of arcade games for the ZX81 is likely to lose much of this one. No sound or colour, of course, but the Hi-res display really does break new ground. An outstanding achievement.

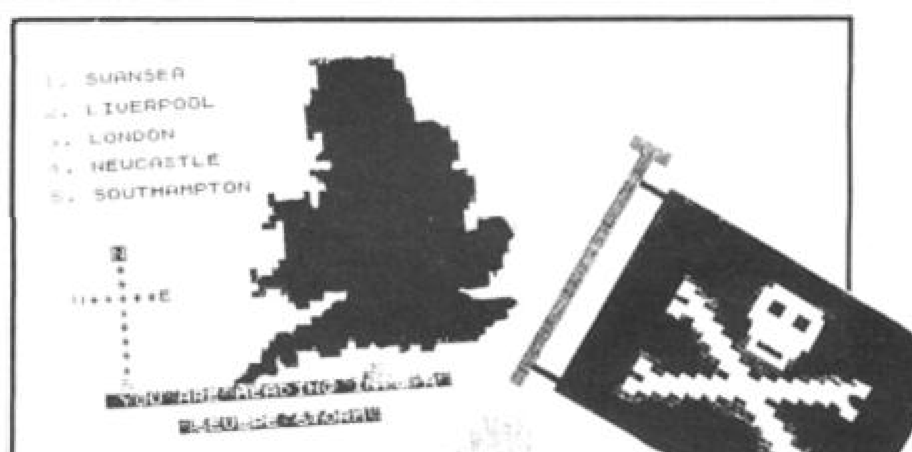
The use of high resolution graphics will almost certainly open up a whole new generation of ZX81 software as other software houses follow suit.

An excellent game.

Invaders costs £4.95 from Odyssey Comuting, 28 Bingham Road, Sherwood, Notts NG5 2EP.

Ocean Trader and Pioneer Trail — Quicksilva

Ocean Trader is a role playing adventure game set in the nineteenth century in which as captain and owner of a 130 ton sailing barque, your aim is to make a profit of £½m and retire. To do this you buy and sell coal, whisky and other cargos, sailing from port to port looking for a good price for them. Hazards abound and during the voyages you will encounter pirates, severe storms and overzealous insurance agents, to name a few.



Some sample screen illustrations from the program, Ocean Trader.

You make money by virtue of the varying prices in each of the five ports, but it is a slow and frustrating process just breaking even — never mind that elusive £500,000 profit you are after. You can lose half a valuable cargo in a severe storm, and if you cannot meet your insurance bills your ship can be impounded!

Your home port is Swansea. A finance company here will loan you money if you require (you certainly will!) but beware, interest increases by 12½% each time you sail from port and there is a limit of £25,000.

The game is in two parts. The first comprises comprehensive on-screen instructions; the main game is loaded separately. This format enables the full 16K to be used for the game itself, but does have the penalty of extended LOADing times. The graphics accompanying the on-screen instructions are particularly impressive.

Ocean Trader is a well thought out and enjoyable game. You will need to be a quick witted trader, and have luck on your side, to earn a rich retirement.

Pioneer Trail is set in 1847 when your family joins the trail to Oregon. You have 40 weeks to travel the 2,000 miles.

Your assets consist of two tired old horses and $700 to spend on supplies; not a very auspicious beginning. You test your rifles before embarking on the trail, this is done by typing the changing letter or number on a moving target. You will need to be a good, and lucky, shot if you are to overcome the dangers of the trek.

From then on you move along the trail towards your destination. You have the opportunity to stock up at forts along the way (finances permitting), and hunt for food. Dangers are encountered frequently and include hostile travellers, outlaws, rattlesnakes, severe weather and more. You can select one of 20 levels of play from beginner to experienced pioneer.

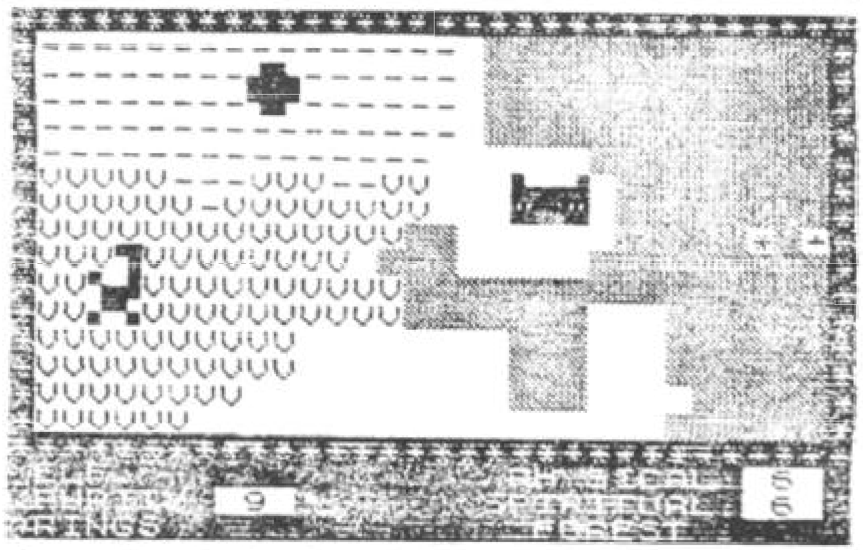
Limited use is made of graphics during the game. Instructions are displayed on-screen at the start.

The incorporation of an interactive element can add a touch of excitement to adventures, but I must admit that I found 'shooting' the target on Pioneer Trail rather uninspiring; success appeared to depend more on chance than reaction time or skill. Nevertheless, an entertaining game.

Ocean Trader and Pioneer Trail cost £3.95 each from Quicksilva, Palmerston Park House, 13 Palmerston Road, Southampton SO1 1LL.

Black Crystal — Carnell Software

Black Crystal is another role playing adventure in which you can become a warrior, wizard or elf in a quest to find and use the rings of creation to destroy the Lords of Chaos. Black Crystal is split into six parts which have to be played in the correct sequence in order to take the player through the Land of Beroth, the Castle of Shadows, Shaggoth's Lair and to the Black Crystal itself in the Dark Tower.



A screen illustration from Carnell Software's Black Crystal

The six parts are supplied on two cassettes which come attractively boxed with a short booklet. This gives details of the various maps and commands, and contains a short story to set the scene.

It seems that evil has returned to the earth, and you have to find the lost rings of creation to banish evil from the universe forever.

A load level check precedes the first program. On LOADing this displays a map of the Kingdom of Beroth and is the doorway to the other map sections. The cursor keys are used to move around the map in the usual way. However, the intrepid warrior (or whatever character is chosen) is frequently challenged by monsters of various types. Monster battles are in real time and although physical and spiritual powers can be used in attempting to overcome your opponent, there is a good chance that it will win and you will be sent back to sanctuary at the beginning.

You are challenged so often that it is very difficult and requires considerable perseverance to get more than a few steps into the game. Even after cheating — I broke into the BASIC listing and altered the rules so that I could continue after being 'killed' in battle and not sent back to sanctuary — it is not easy to make significant progress.

I think this game really needs re-wording to make the initial stages less difficult and less reliant on chance, otherwise a large part of the adventure is likely to be uncharted by all but the most persistent players.

By splitting the adventure into six programs Carnell have certainly been able to provide considerably more variety and detail than otherwise, but this does mean that six lengthy LOADs are needed to complete the game. Each program contains a game SAVE facility.

Black Crystal costs £7.50 from Carnell Software, 4 Staunton Road, Slough, Berkshire.

Home Doctor Series — Eastmead Computers

Turning to a suite of programs of a more serious nature, the Home Doctor series from Eastmead Computers is designed to educate and advise the user on a comprehensive range of medical topics.

There are six cassettes in the series which cover Basic Medicine, Mainly For Women, Mainly For Men, All About Children, How Healthy Are You, and 101 Home Nursing Tips. Each cassette contains an average of 18 programs.

On LOADing the first cassette — Basic Medicine — you are first asked some general questions about your health, eg any recurrent pains, unexplained bleeding, etc, and if the answer of any of these is 'yes' you are told to seek medical advice. A similar routine precedes each program in the series.

The Basic Medicine program then lists 17 subprogram names — abdominal pain, accidental injury, bleeding, etc, from which you load the program you wish to use. This format is used throughout the Home Doctor series and means that unless you have previously located the start of each program with a digitiser you are likely to spend considerable time waiting for your selection to be found and LOADed. Let's hope your injury does not cause too much discomfort in the meantime!

The method of giving advice is also repeated throughout the series. You are asked a sequence of questions, the answer 'yes' almost invariably advises medical help. 'No' sends you to the next question and so on, until you have been through all the manifestations of your chosen symptom in gory detail. You will probably find yourself cured by the very relief of being free from the many horrible agonies you *could* be going through.

There are few subprograms where this yes/no question format is not used. On the How Healthy Are You program, for example, Memory Test displays a card containing words and numbers which you are asked to memorise. Disappointingly, there is no indication from the result whether your memory is good, poor or how it might be improved.

I am certainly not qualified to question the advice given. Generally it seemed sensible and appropriate. I was a little concerned about the advice to skinny persons wishing to gain weight: eat quickly and you will be able to cram more food into your stomach before feeling full — and make you sick into the bargain I shouldn't wonder!

The whole series costs over £30 and I couldn't help feeling that the amount of money would be better spent on a good book on medical matters.

The Home Doctor cassettes cost £6.75 plus 45p postage and packing each, or £35.75 post free for the complete series from Eastmead Computer Systems Ltd, Eastmead House, Lyon Way, Camberley, Surrey.

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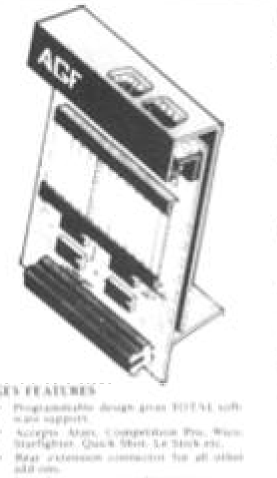
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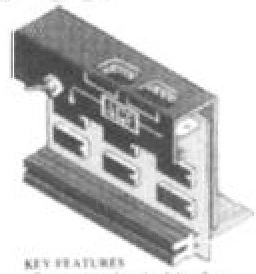
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Facts from the Fair

Our roving reporter checks out the microscene at the 7th ZX Microfair.



The day was June 4 — not a particularly inspiring date except for the fact that this was the day that the 7th ZX Microfair was to take place. Complementing the 130 suppliers were over 8,000 visitors to the exhibition in its new, and as it would seem, permanent home in the Alexandra Pavilion (or as we Londoners think of it, 'Ally Pally').

There were many new companies at the show, and it was very evident that the stands were put together very professionally. Vortex, an extremely new company, had one of the most prominent stands at the show. Vortex were selling two Spectrum games, Android One and Gun Law. They also had a great game for the ZX81 called Astral Convoy.

Protek Computing, a new Scottish-based software company, were exhibiting a wide range of hardware and software, including a cursor compatible joystick interface for the ZX Spectrum. Another new company, Apocalypse Software had, what I thought, was the best software deal I've seen for a long time — they had two extremely good games on one tape for a mere £4.90. They also had some useful utilities for the Spectrum so they might be a name to bear in mind when you're looking around the software shelves.

Old favourites, Quicksilva, had a stand at the show which looked more like a space-age house. They were exhibiting their latest titles to a large and interested crowd. As were Artic, who were showing five of their new programs for the Spectrum.

Hewson Consultants, famous for their 'Nightflight' flight simulation program, have now released a new software package called 'Heathrow — Air Traffic Control'. In this you must talk several aircraft down onto the runway, trying to keep their flight patterns regular and avoiding air collisions, etc. Hewson also gave away plans for a game called 'Quest' which they are soon to release. In this adventure, with 133 locations and sporting full graphics, you get to play one of five characters and fight various creatures — one of which is a Hobbit (some backstabbing here, maybe?). The idea behind the game is to accumulate points and eventually find the scroll which holds the clue to finishing the game. Hewson don't think anyone will finish the game in under six months — and I think they're probably right!

Softek, who fronted an impressive six table stand, were displaying a wide range of Spectrum software of arcade quality. Automata also had an impressive display of software, with one particular package, Automonopoli, which was the best adaptation of that game that I have ever seen. They also added a fair amount of good cheer by serving up the champagne at just the right moment.

The hardware company, Eprom Services, were displaying various new add-ons for the Spectrum and ZX81 including an Auto Start board and A/D convertors.

But software was really the main attraction of the show for me, and Emsoft had a 3D graphics package which really quite amazed me. An 'X' was simulated on the screen in three dimensions, and was then made to spin round at speeds faster than I've ever seen before. The package also allowed you to enlarge the 'X' and even incorporate the 3D facility in your own programs. Procom, yet another new company, had two Spectrum programs on display, Breakaway and Character Design, which were both worthy of praise.

Of the clubs at the show, all had a range of software written by various club members. The Staines and Stanwell Computer Club had a Cesil interpreter, the Stevenage Club were selling graphics aids, and the people from the Aylesbury Computer Club were selling practically everything (as usual!).

At the end of the day, I'm sure everyone would agree that the show was a definite success. I, for one, am really looking forward to the next one!



Sinclair Advanced Research

Sinclair Research are to invest over £2 million in establishing MetaLab, a new advanced research centre. At this new establishment, Sinclair Research will be exploring revolutionary and high risk ideas with a view to developing new products in high technology.

Sir Clive Sinclair believes that MetaLab will provide a challenging 'think tank' atmosphere for a highly motivated multidisciplinary and creative scientific team which it is now seeking to expand.

"MetaLab will act as an incubator, fostering new products from initial idea to commercial launch" said Sir Clive . "Not only will MetaLab complement research work underway in existing computer and television divisions — it will also open up totally new fields ranging from battery technology to robotics".

The MetaLab complex is planned to open in the Autumn. Watch these pages for future developments of Sir Clive's latest endeavour.



Congratulations!

As recognition of his achievements in the British micro industry, Clive Sinclair, Chairman and Chief Executive of Sinclair Research, is to be knighted as part of this year's Queen's Birthday Honours.

Said Sir Clive on hearing the news "The award of a knighthood is a truly great honour and one I value very highly. It was completely unexpected and a wonderful surprise. More than ever, I feel committed to achieving success here, in and for Britain."

As readers of *ZX Computing* and faithful users of ZX micros, I'm sure you will not need us to tell you of his many successes over the past 20 years, so it only remains to wish Sir Clive all our congratulations.

Safe As Houses

Computers For All have announced a complete warranty extension plan for home computers, printers, disc drives and monitors.

Called the Computersafe Extended Guarantee Plan, you can extend your manufacturer's warranty for a further 12 months covering such items as complete cost of repair through mechanical or electrical breakdown, etc. The insurance has been organised by Computers For All in conjunction with Domestic and General Insurance Co Ltd.

The extended guarantee is unique in as much as it will be serviced through all Computer For All dealers as well as most *bone fide* computer repair companies.

Further information is obtainable from Computers For All, 72 North Street, Romford, Essex. Telephone enquiries can be made on 0708 752862.

The Return Of Horace

Sinclair Research, in a further expansion of its software library, have released nine new cassette programs, including an additional language, FORTH, an advanced chess program and yet another adventure for the intrepid Horace.

For ZX81 and Spectrum users with plans on increasing their programming interests comes a new FORTH program offering a language combining BASIC's simplicity with the speed of machine code. FORTH is extendable by user-defined commands, and its compiled code occupies less than a quarter of the equivalent BASIC program yet runs up to ten times as fast. Both versions for the ZX81 and Spectrum are available at £14.95.

A major challenge for the games enthusiast is the new eight level chess program for the Spectrum called Cyrus-IS-Chess. Based on the original Cyrus program which won the second European Microcomputer Chess Championship, it features cursor movement of pieces, replay and take-back facilities, as well as the ability to function as a normal two-player game board. The Cyrus-IS-Chess program is priced at £9.95.

In amongst the serious titles, there are, of course, five new software games packages for the ZX81 and Spectrum. And Horace rears his head once more in a program called Horace and the Spiders. In this, his third program, you have to help Horace survive the traumas of the mountain and the bridge before engaging the Spiders in a deadly duel in their web. Horace and the Spiders is available for £5.95.

Other games for the Spectrum include a full feature Backgammon game and Scrabble which features over 11,000 words in its memory and four levels of skill. Backgammon and Computer Scrabble are priced at £5.95 and £15.95 respectively.

For the ZX81 with 16K RAM, Sinclair Research have introduced two new adventure games, Sabotage and City Patrol. These two tapes are priced at £4.95 each.

Finally, meeting the growing demand for business software, Sinclair Research have also released a program for the 48K Spectrum called Small Business Accounts. This program, priced at £12.95, provides balance sheet and profit and loss information together with VAT returns.

All the new cassettes are available via mail order from Sinclair Research, Stanhope Road, Camberley, Surrey. They should shortly be on sale in major branches of WH Smiths, Boots, Currys, John Lewis Partnership, House of Fraser, John Menzies and Greens, and other leading chains and computer stores.





Hardware .... In Brief

• AGF Hardware have introduced a Programmable Interface for the ZX Spectrum and ZX81. Accepting connection of one or two Atari-compatible joysticks, the new interface offers users compatibility with all games software through a unique programming design. Keyboard operation is not affected by the interface and expansion is accommodated through an extension edge connector. Full instructions are supplied with a demonstration program which allows high resolution drawing to be made under joystick control. The price of the programmable interface will be £32.95 plus £1.00 postage and packing. For more information get in touch with AGF Hardware, 26 Van Gogh Place, Bognor Regis, West Sussex PO22 9BY.

• If you're having problems with a wobbly RAM Pack, Adapt Electronics may have come up with a solution to your worries. The RAMLOK kit consists of a gold-plated male connector which replaces the computer connector and, through an ingenious mechanical clamping device, clamps the RAM pack to computer. The RAMLOK kit is easily fitted and requires no cutting, drilling or special tools. Step by step instructions are included allowing for simple installation. Priced at £7.50 plus 50p postage and packing, you can find out more about RAMLOK from Adapt Electronics, 20 Starling Close, Buckhurst Hill, Essex IG9 5TN.

• Cheetah Marketing Ltd have introduced a 32K RAM pack for the 16K ZX Spectrum allowing it to be upgraded to a fully fledged 48K machine. Its injection moulded case has been specifically designed to fit the contours of the ZX Spectrum thus hopefully eliminating the worries of the 'wobble'. The device is fully compatible with all Spectrum accessories. Now available on mail order, the RAM pack will soon be sold through selected retail outlets. All the devices are tried, tested and guaranteed, and are priced at £39.95. For further details contact Cheetah Marketing Ltd, 359 The Strand, London WC2R OHS or 'phone 01-240 7939.

• A speech synthesiser for the Spectrum or ZX81 is now available from Spirit Instruments. Housed in a sturdy case, the speech synthesiser plugs into the back of your computer, providing speech from its own built-in speaker or output to your hi-fi. Programming speech using the device is simple, and full instructions are provided with the package. For further details contact Spirit Instruments, Station Road, Maldon, Essex CM9 7LQ or 'phone 0621 56969.

• If you would like to get more sound out of your Spectrum then look no further than the new device from Compusound. Housed in a small box, the device has three leads which are attached inside the Spectrum via crocodile clips. Full details on how to connect up the unit are given with a comprehensive diagram for the nervous. Once connected you will get all the 'zaps, pows and booms' from your games through the speaker in the TV — so you can now drive everyone in the house mad with deafening explosions as you destroy the alien fleet! For more details have words with Compusound, 32 Langley Close, Redditch, Worcs B98 OET or 'phone 0527 21439.

Are You In Touch?

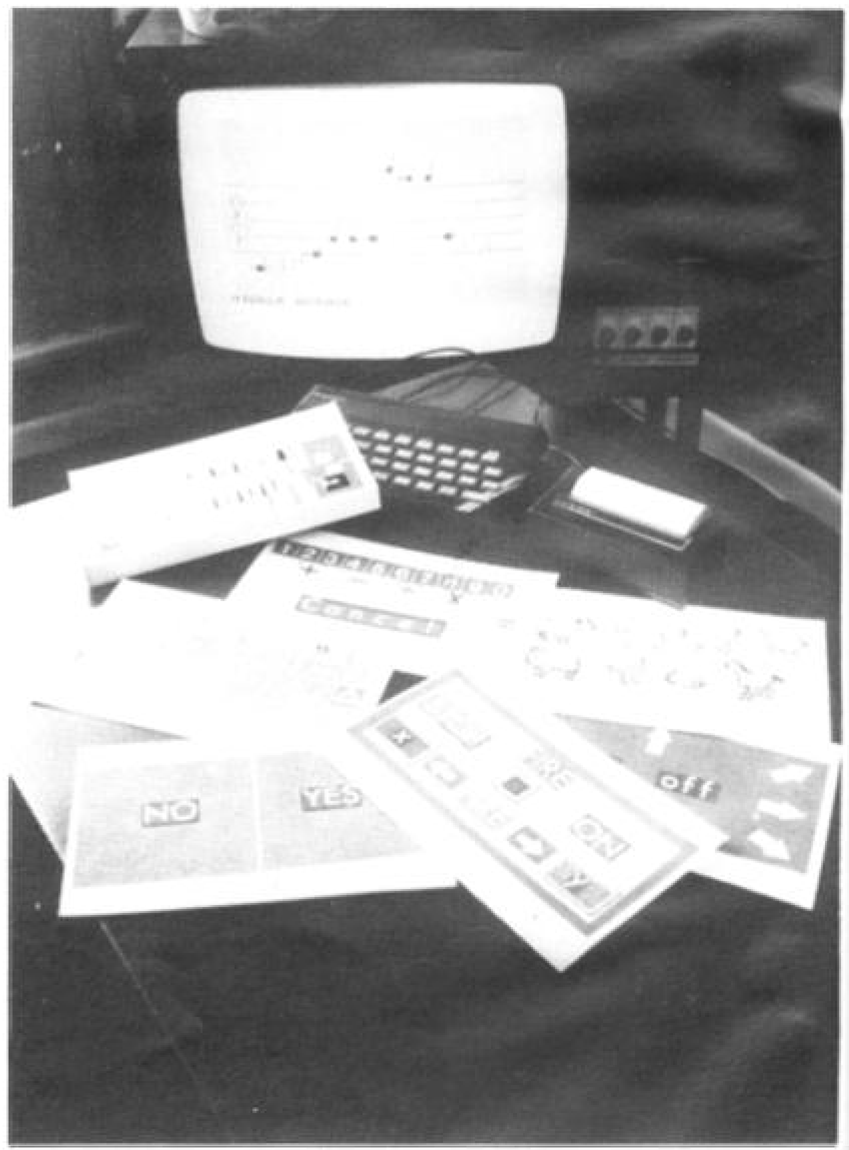
Tactile have introduced a new concept in keyboard overlays for the Spectrum which is aimed at early education programmers, teachers and parents thus allowing the Spectrum to become a much simpler teaching aid.

The Tactile keyframe, with its touch sensitive membrane, fits snugly over the computer and allows you to create your own easily changeable over-keys. The key surface can be configured as one large key or up to forty individual, user-defined keys using simple IN or INKEY$ instructions; prepared instructions are enclosed with the package to help you adapt your programs to suit the new key layout.

The complete set includes a keyframe, coloured, white and clear backgrounds, symbols and shapes, allowing you to construct an infinite variety of over-key panels. A piano keyboard and a simplified children's typewriter layout are also included.

The software company, Early Learning Opportunities, is to market software compatible with this keyframe and pictorial overlays.

For further information on these products get in touch with Tactile on 0272 678431 or write to Tactile, Wraith, 32 Elmfield, Kingswood, Bristol BS15 2SS.



Going Mobile

If you ever wanted to combine the hobby of computing with robotics then you may be very interested to learn about the Zeaker Micro-Turtle.

The Micro-Turtle is a two-wheeled mobile robot whose

movements can be controlled by any microcomputer, including the Spectrum and ZX81, via a connecting umbilical ribbon cable. Suitable software is provided to permit the movements to be memorized and reproduced.

Sensors indicate when the robot touches an obstacle and the computer instructs it to find an alternative route. An additional feature of the machine is that it has an in-built retractable pen which can be used to trace its path across a surface. The pen itself is controlled by the computer and is indicated by an LED on top of the robot; two other LEDs indicate which direction the Micro-Turtle is travelling in.

The unit comes complete with interface, power supply and operation manual, as well as the necessary software to suit your particular computer.

Aimed at the educational market, as well as anyone else interested in control systems, the unit has been priced very competitively. The Micro-Turtle is avilable as a kit priced at £52.00 + VAT or fully assembled at £69.50 + VAT.

For further information on the Zeaker Micro-Turtle contact Colne Robotics Co Ltd, Beaufort Road, Off Richmond Road, East Twickenham, Middlesex TW1 2PH or 'phone 01-892 8197.

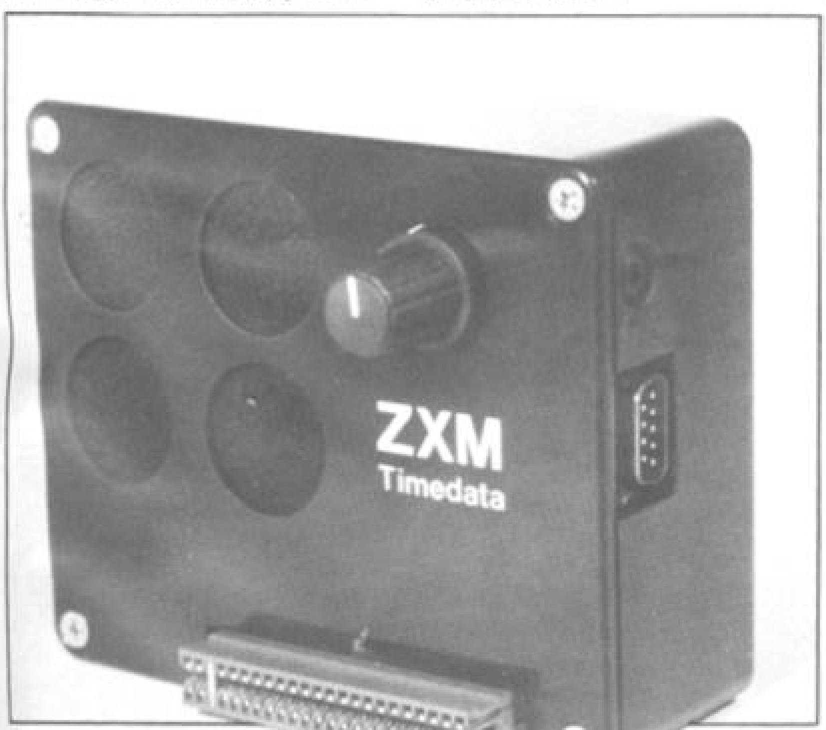
Sounding Out

Timedata, computer publishers, have now spread their business wings and are introducing a range of hardware add-ons for Sinclair computers.

Their first product in the proposed new range is the ZXM Sound Box. Retailing at £29.95 inclusive, the Sound Box uses the 8912 three channel sound generator chip to provide a wide range of programmable sound effects. The built-in amplifier and loudspeaker can also be used to boost the Spectrum's own BEEP.

Not that the Sound Box can be used exclusively with the ZX Spectrum — it can be used with the ZX81 without the need for an adaptor. The ZXM also has a nine pin I/O socket which can be used with Atari/Commodore joysticks. Other Sinclair add-ons can be plugged into the back of the Sound Box.

For further information on the ZXM Sound Box and details of their other products which should be forthcoming over the next few weeks, get in touch with Timedata Ltd, 16 Hemmells, High Road, Laindon, Basildon, Essex SS15 6ED. Telephone enquiries can be made on 0268 418121.





Keyed Up?

Dk'Troniks have introduced a new keyboard which will function with both the ZX Spectrum and ZX81.

Launched at the recent Midland Computer Fair, the new cased keyboard includes 52 keys, 12 of which are used for the numeric keypad. The keypad is a repeat of the one to nine keys plus full stop and Shift keys. Measuring 15 inches by 9 inches by 2½ inches, the cased keyboard is coloured black with grey and red keys.

The computer, either the ZX81 or Spectrum, fits neatly inside the case; although the computer is removed from its original case, the base of the case has been customised to allow for easy fitting. Also fitted inside the case can be a motherboard (ZX81 model only) which allows 16K, 32K or 64K RAM packs to be fitted. There is also room inside the case for other add-ons to be included such as the Power Pack.

All the connections usually found at the back of your computer are to found at the back of the keyboard case, ie Power, MIC, EAR, TV and the expansion port.

Priced at £45 inclusive, you can find out more about the keyboard case from Dk'Tronics, Unit 2, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AX. You can always 'phone them on 0799 26350.

The ZX Floppy

Analogue Information Systems Ltd are introducing a floppy disc controller for the ZX81 which should prove invaluable to anyone contemplating using the ZX81 for business applications.

The controller offers single or double density compatibility with all Shugart 5¼ inch drives, the new Japanese 3 inch drives and the new Hungarian MCD1 3 inch drives. It also allows the use of single or double sided drives up to any number of tracks.

An important part of the controller board is the disc operating system which is supplied in ROM. This gives a simple disc interface to BASIC involving no USR calls, POKE, PEEK, etc. The DOS commands are many and are available directly from a BASIC program, from the BASIC command mode or from machine code.

At the time of writing the controller board is set to enter the market at around £40.00 inclusive, available by mail order only. For further details of the floppy disc controller board contact Analogue Information Systems Ltd, 43 Gilmour Road, Edinburgh 16 or 'phone 031-667 6862.

Software.............. In Brief

• A tape which demonstrates three top-line Hilderbay programs for 48K Spectrum is now available priced at £3.95 (a fraction of the price of the software it demonstrates). The demo program illustrates the three programs, Payroll, Stock Control and Statutory Sick Pay. This lets people get some idea of the content of the software before they take the plunge and part with their money. For more information on this tape get in touch with Hilderbay Ltd, 8/10 Parkway, Regents Park, London NW1 7AA or 'phone 01-485 1059.

• Following the success of Accounts ZX81 comes the launch of a similar piece of software for your 48K Spectrum called (of course) Accounts Spectrum. The programs featured on the tape are aimed at both practising accountants and businesspeople and can improve the efficiency of routine accounting. If you require any further information get in touch with Hestacrest Ltd, PO Box 19, Leighton Buzzard, Beds LU7 0DG or 'phone 052-523 785.

• Collins have released the Spectrum Starter Packs 1 and 2, which comprise a tape and booklet explaining the programs included on the tape. Providing a range of programs which have both sound educational content as well as being fun to play, these packs are designed for children and their parents to learn to handle the ZX Spectrum. Priced at £9.95 each, you can find out more from Collins Educational, 8 Grafton Street, London W1 or by 'phoning 01-493 7070.

• Direct from Silicon Valley North comes a piece of software for the ZX81 called Gradebook. Aimed at teachers and professors, Gradebook is menu driven, allowing the user to manipulate data, such as exam marks, by different distribution methods. There are also built-in routines allowing you to print out displays. Supplied with full documentation, the price of the package is £6.25 plus £1.00 postage and packing. Orders can be made from Silicon Valley North, PO Box 2442, Hammond, Indiana 46323, USA.

• Virgin Games Ltd have produced a number of software packages for three of the most popular micros, including the ZX Spectrum. Of the four programs released, two packages, Starfire and Sheepwalk, are designed to run on the 48K machine. The other two packages, Golf and Yomp, are designed to run on either version of the Spectrum. All of the new programs are priced at £7.95 each. For more details contact Virgin Games Ltd, 61-63 Portobello Road, London W11 3DD or telephone 01-221 7535.

• Micromega have announced their Spring collection of software for the Spectrum and ZX81. All priced at £4.95, for the Spectrum there is Monte Carlo, Roulette, Dominoes and Brainstorm. The final package is Gulpman, which also includes an advanced 16K ZX81 version on the same cassette. For further information on the new range of software contact Micromega, Personal Computer Division, Quantec Systems and Software Ltd, 230-236 Lavender Hill, London SW11 1LE or 'phone 01-223 7672.

• Hisoft have released two new packages for the Spectrum. The first is Pascal 4 and is a complete implementation of Pascal for the Spectrum and is priced at £25.00 inclusive. The second package is called DEVPAC 2 and is an upgraded version of their current assembler, disassembler/debugging program. The DEVPAC 2 package is priced at £12.50 inclusive. Both packages come with comprehensive documentation from Hisoft, 60 Hallam Moor, Liden, Swindon, Wilts SN3 6LS. Telephone enquiries can be made on 0793 26616.

For The Record



A computer game pop single was recently released by EMI Records (UK). The single, by Chris Sievey, features a self-penned song, Camouflage, on the A-side, while the B-side contains three of his programs for the ZX81.

The programs, once played into the ZX81, will produce one demo program — illustrating the lyrics of the A-side with text and graphics — and two games programs, one for the 1K and one for the 16K ZX81. These games are versions of an arcade-type game called Flying Train.

Chris Sievey's single will be in your record store at the moment, but should you have any problems in obtaining your copy try contacting EMI Records (UK) at 20 Manchester Square, London W1A 1ES. I haven't managed to see the programs yet, but anyone who could release a single entitled 'I'm in love with the girl on the Manchester Virgin Megastore checkout desk' must have something going for him!

This is not, however, the record industry's first foray into the world of computing. Mainframe, a band comprising Murray Munro and John Molloy, released a single called 'Talk to me' in which they have included material for the Apple computer, ZX81, Spectrum and the BBC Computer. For more information on Mainframe, get in touch with MC² Music, 24 Missden Drive, Hemel Hempstead, Herts.

BASICally, It's A Magazine



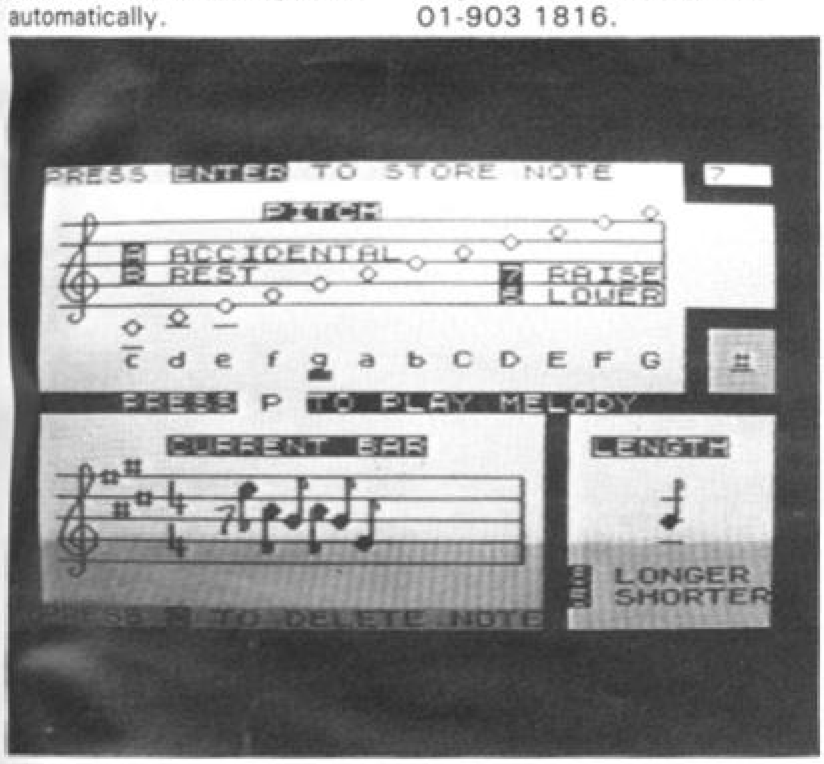
The Sound Of Music

If you ever wanted to play and compose music on your 48K Spectrum, Bellflower Software may have come to your rescue.

As well as using the Spectrum's own BEEP command, the program has successfully managed to meet the challenge of representing each note on the screen in accurate musical notation. It will play and print melodies in 11 different keys, each with a choice of 12 time signitures and ten playing speeds. Rests, accidentals and dotted notes can all be programmed into the tune and bar lines are drawn in their correct places automatically.

Don't worry if you don't rate yourself as an expert musician because all the musical knowledge you need is stored in the computer and tunes can be put into memory using single keys to make choices from the screen display. Starting off as a beginner, you can check that what you are doing is correct by comparing your efforts with the three tunes supplied with the program. Once you have input your tune, you can get the computer to print out the tune note by note as it plays it for you.

Available at £5.75, you can find out more information by contacting Bellflower Software, 6 Rosewood Avenue, Greenford, Middlesex. Telephone enquiries can be made on 01-903 1816.



A revolution in computer magazine publishing was witnessed last month with the launch of 'Spectrum Computing' — a bi-monthly magazine on tape!

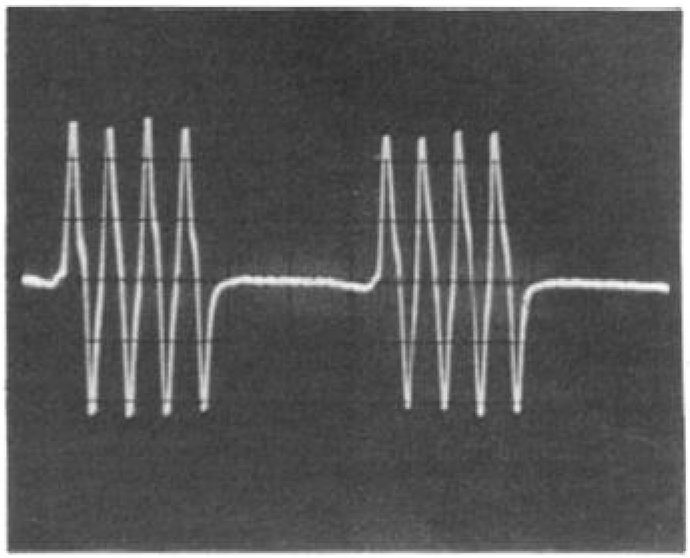
Edited by Iolo Davidson, the new magazine, Spectrum Computing, is available for £2.99. Altogether there is some 80K of code which readers follow through a series of on-screen prompts. On the first issue, designed for both the 16K and 48K models, there were software reviews (including 'stills' from the programs under review), a Morse code trainer, chess graphics, a routine for turning text upside down and sideways, as well as a couple of arcade games thrown in for good measure.

Said Iolo "I've put in the sort of things that interested me. We don't want to go over the heads of some of the readers nor do we want to talk down to them. It's a difficult balance to strike and I hope I've achieved it".

Perhaps this shows the shape of things to come — maybe soon the computer bookshelves in the newsagents will be filled with cassette magazines.

Spectrum Computing is published by Argus Specialist Publications, owners of *ZX Computing*.

Fast Loader



JRS Software have developed a unique system for their software for the ZX81 which will enable programs to be loaded at the maximum speed possible within the limits of the computer itself, ie without the need for additional hardware.

Data is loaded at between 300 and 500 bytes per second, or 10 to 15 times faster than the normal ZX81 rate. This means that almost every program for the ZX81 could be loaded in under a minute — a very effective cutting of the loading time.

This breakthrough has been achieved by drastic modification of the I/O signals whilst limiting the maximum frequency to 4KHz to guarantee reliable operation even when using poor quality tapes or low-cost cassette recorders.

JRS Software are based at 19 Wayside Avenue, Worthing, West Sussex BN13 3JU.

The Artic Arrivals

Artic Computing have released nine new titles to complement their growing range of software for the ZX81 and Spectrum.

First up are two chess programs. Spectrum Chess II is for the 48K Spectrum and incorporates no skill levels — you just specify how long you want the Spectrum to think and it will come up with the most challenging move. The other chess program is called Chess Tutor and operates on the 16/48K Spectrum. This program not only plays chess on three different levels but also coaches the beginner to expert level. Spectrum Chess II and Chess Tutor are priced at £9.95 and £6.95 respectively.

There are also some games for the Spectrum including Cosmic Debris (48K), 3D Combat Zone (48K), 3D Quadracube (16/48K) and The Golden Apple (48K). These tapes are priced at £4.95, £5.95, £4.95 and £6.95 respectively.

There is also a software package which enhances the power of the Spectrum so that you can produce 64 column copy which can even by LISTed without any extra commands. This package, SYS 64, is suited to the 16/48K Spectrum and is priced £6.95.

The two packages released for the ZX81 are Reversi, incorporating four levels of play, and Raider, a version of the arcade game Scramble. Both tapes require 16K memory and are priced at £5.95 and £3.95 respectively.

For further information on these new releases contact Artic Computing Ltd, 396 James Reckitt Avenue, Hull, North Humberside.

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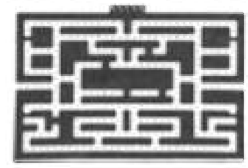
Vampire Bats - that cling to your ship and make controls sluggish

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Beat that high score!
Gobble those dots before those meanies gobble you!
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Improved Mk 2 version!

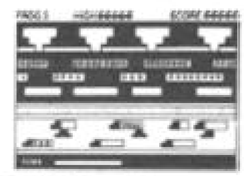
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- On screen scoring
- High score with enter name facility
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Reader's reviews

Read what you, the reader, think of software commercially available for your micro.



This feature provides you space to air your views on any software, be it for the ZX80, ZX81 or ZX Spectrum. If you've had a good or bad experience of any of the commerical software packages available for your micro, why not write and tell us.

Your reviews should contain your critical thoughts about the software and the relevant details concerning the availability of the package, its price, etc. If you can provide any screen dumps to illustrate the review, so much the better. Any reviews published in this section of the magazine will be rewarded with the price of the tape you review. So, if you buy a cassette and send in a review that gets published, you'll get your software for free!

Spectrum Pascal
Hi-Soft
David Bolton

How would you like to write programs in a language very much like BASIC and then run them at machine code speeds? It is now a very practical suggestion with the release of a full Pascal compiler for the 48K ZX Spectrum by the British company Hi-Soft.

Before I look at the Spectrum version, let me give you a little history of Pascal. It is a very young language, born in 1969 when a leading computer scientist called Wirth decided that ALGOL, the then leading academic language, was getting too complex. He designed Pascal specifically to teach good programming practices. It is now available in many forms on disc-based machines, but there are very few implementations on cassette driven micros.

Pascal is very similar to BASIC in many ways, certainly much closer than languages like FORTH, LISP, assembly or PILOT. It is generally a much better language.

This version of Pascal is a very high quality product comprising some 20K of machine code for the compiler, editor and run-time package. It completely compiles a Pascal program into Z80 machine code which runs very fast indeed. Try filling an array of 7,000 elements in half a second, or summing up the numbers one to 20000 in seven! Obviously one could write faster programs using an assembler, but try assembling A= LOG(SIN (B/180 *22/7) − 10.45) − 8/2.2234!

When the compiler package is loaded it starts in the editor, allowing the programs to be typed in, or loaded from tape. Hi-Soft have been very cunning with their editor as it completely bypasses the Spectrum's single-key entry system. Programs are entered line by line just like BASIC with a line number at the start of each line:

```
10   PROGRAM DAVE;
20   VAR I,J:INTEGER;
30   BEGIN
40   J:=0 ; FOR I:=
     1 TO 100 DO
50   J:=J+1;
60   WRITELN ('J = ', J:5)
70   END.
```

The line numbers are at the start of each line for purposes of the editor only, they have no bearing on the program. Commands are included to do the equivalent (in BASIC) of AUTO, DELETE and RENUMBER as well as searching and moving. There is also quite comprehensive commands involved with line editing which can do find, insert, replace and delete on one line.

Overall, the editor is not as good as a screen editor, but it is the next best thing and for anyone used to Sinclair editing it is a significant improvement.

The editor only changes the 'Source code', ie the program as it looks above. Once a program has been compiled into machine code (or object code as it is known) it can only be changed by changing the source code and re-compiling.

Source code can be saved onto tape and it's quick to do so because Hi-Soft uses tokens (just like BASIC) to represent reserved words, eg PROGRAM and INTEGER only occupy 1 byte each in internal storage. When source code is loaded into RAM it appends onto the end of any existing code; this makes the creation and use of libraries much more convenient.

One problem with the editor is that there is no keyboard beeping. I tried unsuccessfully to get it to work, even writing a short program to POKE 23609 with 255, but to no avail. As soon as I exited from Pascal to BASIC the beeping started working again.

Compilation is the process which converts source code to object code. There are two ways of doing this in Hi-Soft Pascal: the first is for debugging purposes, and keeps both source code and object code in RAM at the same time to speed up the EDIT-COMPILE-TEST cycle. When testing is complete the specially compiled object code can be dumped out to tape so that it will automatically LOAD and RUN as a stand-alone program.

If a syntax error is discovered during compilation then the choice is given of stopping and going into the editor at the faulty line, or listing other errors. Pascal is typical of compiled languages in that one error early on can generate lots later.

Compiling is a very quick process, but it will be slowed down if the compiler provides a listing at the same time. The Spectrum 'write character' routines are not terribly fast, so if the compiler listing is disabled then the compilation takes place in a short period of time and instantaneously for small programs.

There are seven compiler options which determine whether or not certain checks will be incorporated into the machine code. They check such things as overflow in integer addition/subtraction, or checking if array references go out of bounds. The idea of these checks is to include them while testing and debugging and then remove them in the finished program. Some of the other options are used to control compiler listing or printing.

Tape and I/O facilities are included for the program to store variables on tape and read them back in. It is non-standard for Pascal but is very powerful as just one statement can write out or read in any variable from one character up to a very large array.

The I/O ports used on the Spectrum can be read and written to by use of the INP function and the OUT procedure.

A statement similar to INP, (OUT(X,C) is used to output a ▶

character byte C to port X.

Statements and functions are included to allow reading from and writing to RAM. Again non-standard for Pascal, these are taken from BASIC and are PEEK and POKE. Both are much more versatile than their BASIC equivalents as they can work with single characters up to entire arrays. For example, POKE (£A000, 'DAVID BOLTON') will deposit 12 characters in RAM from A000 onwards.

As well as the statements described above, there are a couple of features which are useful for the machine code programmer.

INLINE is a statement which permits machine code to be directly embedded into the Pascal program. It is followed by a list of decimal or hexadecimal integers which represent the machine code.

USER is a function which is similar to BASIC's USR, and permits calls to machine code routines external to the program. For example with the Spectrum, there are lot of useful ROM calls which can be incorporated into programs.

Note that addresses can be also given in hexadecimal form; this is a more useful representation than decimal for integers, because any integer higher than 32767 must be given in negative form.

This is a very impressive product, and certainly one that could be of benefit to any Specturm programmer once he/she has mastered BASIC and wants to advance.

The compiler is fast at its job and produces very quick machine code, and together with the ability to have machine code incorporated in the program should mean that there are not tasks which are better done in assembler than Pacal.

Naturally there are some negative aspects, nothing's perfect, but I consider them fairly minor.

Apart from machine code speed, integer and real arithmetic, better data structuring, recursive procedures and functions, there is also formatted output where you can specify how numbers are written out, with rounding.

For the price of £25 you get the complete compiler/editor and a 60 page reference manual. This is not a teaching manual, so if you are unfamiliar with Pascal I would recommend purchase of a good book. The manual mentions a few at the back.

Ah Diddums Molar Maul Imagine Software Peter Shaw

As I make no secret of the fact that Arcadia is my favourite game, I was naturally pleased to recieve Imagine's latest Spectrum offerings, Ah Diddums and Molar Maul. Both cassettes are very attractively presented in very imaginative (no pun intended) cassette covers, and both packages come with a lifetime guarantee, something which few other software houses offer. Instructions supplied with the tapes give detailed instructions on loading and playing.

I loaded Ah Diddums first, mainly because the cover appealed to me, plugged in my joystick and prepared to fight off the other toys in the toybox. Ah Diddums, as you will have probably guessed, is rather an original idea, concerning a tubby teddy and his mission to comfort the baby. What Teddy must do is take some toys to Baby so she will stop crying, but it's not as simple as that — you see this game has many sub-plots going on. If Teddy comforts Baby then the mother will quite sensibly put the lights out. 'What is wrong with that?' I hear you cry. The trouble is that the toys in the toy box can only play with the light on, so they will do all they can to stop Teddy comforting the baby.

Sounds confusing — well, there's more! Teddy is in a set of 99 nested toyboxes, and to escape from any one of them he must pile building bricks up in a certain order. Also in the toybox (well most of them, I've yet to get out of the first) is a Jack-in-the-Box. This bouncy little fellow takes the pressure off any sticky situations you might have got yourself into. Amongst the toys you can pick up is a peashooter, which I'm still trying to work out what to do with. I tried shooting the soldier who was in the box with me, but all I ended up in doing was making it turn more vicious.

Ah Diddums uses amazing high resolution graphics and sound. It even uses colour, something I dearly missed when they brought out Schizoids. Also Teddy has one amazing walk! I think this program has the edge over Arcadia, but I will not definitely give this the accolade of 'My favourite program' until I have mastered it.

Moving rapidly on, I then loaded Molar Maul. The way the title page was built up was quite fantastic.

I pressed a key and a large set of teeth were displayed on the screen — they then opened and the play area, the inside of someone's mouth is, if not very convincingly, displayed in full gruesome colour. The idea of the game is to fight of the dreaded 'DK's (de-cays — get it?) with your trusty toothbrush and supply of Imagico toothpaste. The game is very fast, and no matter how quickly you can brush one tooth, another is being attacked. The teeth are colour coded so you have an idea of how long they will probably survive.

You have three toothbrushes per game, and you can easily lose these every four cavities you get. You are not helped by the sweets which appear on the tongue, the 'DK's rush over and their power is increased. Altogether, I think Molar Maul is the most original, addictive game for the Spectrum I have played in a very long while.

Both Ah Diddums and Molar Maul are available for £5.50 from Imagine Software, Masons Buildings, Exchange Street East, Liverpool L2 3PN.

Spectrum Golf R & R Software Darren Norbury

Like many other people, I enjoy a game of golf. Unfortunately, the Briitsh climate doesn't always allow me to go and play a few holes anytime I want. I don't mind though. If rain prevents play then I can stay indoors and load Spectrum Golf from R & R Software into my Spectrum.

Having played quite a few different types of computerised golf before, I was pleasantly surprised at how close this program came to the real game.

It is a game for one or two people over a nine or 18 hole course. Each hole is of a completely random construction and can be either a par three, a par four or a par five, with hole lengths ranging from about 160 yards to over 500 yards. Although each hole looks the same length as the last on the screen they are all on different scales.

For each shot, the player is asked for the direction of the shot, and the strength of hit. Direction is based on the numbers on a clockface, assuming that the ball is the centre of the clockface. Strength is gauged simply on a scale of one to 100.

Between the tee and the green of each hole are varying amounts of water, sand and rough for the unwary player to get trapped in as well as the major hazard — trees. Once you've landed in one of these uncompromising positions then life is made very difficult indeed.

This is an outstanding simulation which should appeal especially to the new Spectrum owner. I hope that it is as appealing to non-golfers as it is to me.

My best score? Nine under par, but then there was a very helpful wind behind me!

Spectrum Golf, priced at £4.95, is produced by R & R Software, 34 Bourton Road, Tuffley, Gloucester, GL4 OLE.

3D Defender JK Greye Enterprises Geoff Cheshire

At the time when the software market for the ZX81 was really beginning to take off, one of the tapes which gained the most critical acclaim (and is still a best seller) was the 3-D Monster Maze from J.K Greye software. It may be a different company this year but the author is the same. Escape, from New Generation Software, is based upon the aforementioned Monster Maze, but this time the required hardware is a ZX Spectrum (16K).

Once again, there is a monster involved; once again, the player is trying to escape from the monster; once again, there is just one way out. This, however, is where the similarity with the former game ends.

When the tape has loaded the instructions appear on the screen along with a preliminary warning about the dangers which the player is about to face. The computer then asks you to select a level of difficulty from the scale one to five. Upon pressing a number the game starts.

Lo and behold, you are presented with a slightly angular aerial view of the maze with a high resolution version of your good self in the bottom right-hand corner, raring to be manoeuvered away by the usual cursor direction keys. In the top left-hand corner is the

maze exit. All you've got to do is get from the bottom right-hand corner to the top left. Simple, isn't it?

You're right — it isn't that simple. To get out of the exit you need the axe which is hidden somewhere within the maze. And then, of course, there is the added danger of the tyrannosaurus rex who can be aided, according to whether or not you attempt difficulty levels two to five, by either one, two, three or four of his beastly companions who include a flying pterodactyl in their ugly band.

This is not, as it may sound, a jump on the 'Pacman' bandwagon but rather an original and absorbing game which can become extremely difficult and frustrating.

Escape, priced at £5.95, is available from New Generation Software, Freepost, Oldland Common, Bristol BS15 6BR.



Spectres
Bug Byte
Steven Meldrum

The latest offering from Bug Byte for the 16K or 48K Spectrum is Spectres. For the price of £8 I was certainly expecting an excellent copy of a 'certain arcade game', and I am pleased to say that although it is slightly different to the arcade game, in my opinion it is better!

Before I tell you some of the details of the game, I would like to comment on the packaging, which is first class. A colourful artworked cover (obviously to attract prospective buyers) and detailed instructions which blend a storyline in with the objectives of the game.

As the game is being loaded into your computer, a message appears in the 'PAPER' area of the screen telling you to wait. From then on, the game is run automatically and the Break key is disabled.

The objective of the game is to help your little man, Eddie the electrician, re-wire the mansion (the maze) by fitting light bulbs. There are, however, four Spectres in the maze which have to be avoided. Eddie is aided in his task by four light generators which change the hunters into the hunted. The duration of how long the generators are kept on for is determined by how much fuel Eddie has collected.

Spectres is fast, colourful and very addictive. When I first received Spectres, I spent nearly six hours trying to clear the first maze! Each Spectre had a different colour, name and character. The graphics are outstanding and obviously a lot of thought has gone into deciding the shape of the Spectres.

Sound is used effectively throughout the program, but due to the internal speaker inside the Spectrum it is difficult to hear. (I especially like the 'sparking' noise when a Spectre is ignited.)

After the first maze has been cleared, a totally different structured maze has then to be cleared with your score and men left carried over. Altogether there are three different mazes.

However, I do have a few quibbles. First up, on my copy a bonus 'man' is awarded every 3,000 points and not every 2,000 points as stated on the inlay card. Also, when you reach a certain level (either 9,000 or 12,000 — I can't remember which as my Spectrum is with Uncle Clive at the moment) you get a full set of 'men' and from then on, Eddie is invincible.

But even with these quibbles, Spectres will become a standard by which other similar games will be judged.

Froggy
DJL
Nick Breeds

After loading the game for about five minutes, the game auto-runs and thank goodness, the Break key is disabled which means that there's no way you're suddenly going to lose your best score ever just through a misplaced finger.

The title page is very impressive with a frog bringing on the title of 'FROGGY' in large letters. Four more screenfulls of instructions revealed the scoring mechanism and which controls to use. DJL chose my favourite — the cursor keys ('5', '6', '7' and '8').

On playing the game, a full screen greets you with a busy road, a river full of turtles, logs and crocodiles, and five homes. The game is great fun to play with bonuses for picking up baby frogs, for finishing quickly and so on. Each completed screen brings a new, much harder one. The graphics are superb and very smooth.

WARNING! This game is very addictive and will keep you on the keyboard for literally hours.

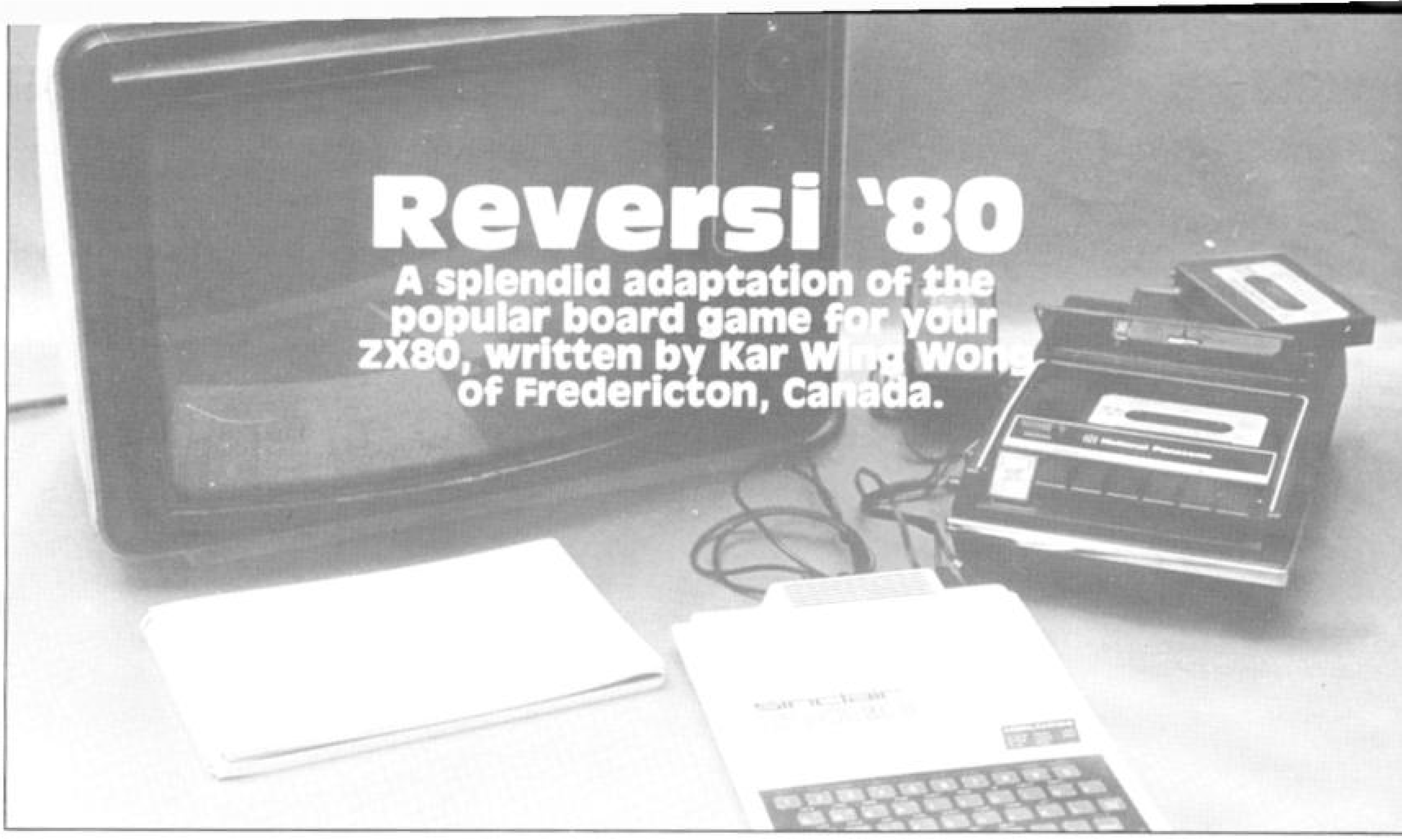
However this is hardly a fault and, all in all, the game is superb. Oh, by the way, the price of the package is £5.95.

For further information on the cassettes reviewed in this article, you can write to the following addresses:

Hi-Soft, 60 Hallam Moor, Lidon, Swindon, Wiltshire.
Imagine Software, Masons Building, Exchange Street East, Liverpool, Merseyside L2 3PN.
R&R Software, 34 Bourton Road, Gloucester GL4 OLE.
New Generation Software, Freepost, Oldland Common, Bristol BS15 6BR.
Bug Byte, 98-100 The Albany, Old Hall, Liverpool.
DJL, 9 Tweed Close, Swindon, Wilts SN2 3PU.

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Reader's reviews,
ZX Computing,
145 Charing Cross Road,
London WC2H OEE.



Reversi '80

A splendid adaptation of the popular board game for your ZX80, written by Kar Wing Wong of Fredericton, Canada.

This program is designed for anyone who doesn't own the board game, but would like to play a game of Reversi with someone other than the computer.

First up, you should type in the program shown in Listing 1. Once this is done, you should type, in the immediate mode:

POKE 16403,20

to get rid of line 1, so that the program won't crash. Now RUN the program and input the numbers on the right-hand side of Listing 2, treating each comma as an instruction to press Newline. After you have finished typing in the data, go into immediate mode and type PRINT B. If the answer is '7026', the program should be OK and you should SAVE what you have so far achieved.

Going over board

From now on, do not try to LIST without a line number, RUN, or press Home or Clear, as you will lose the program. Now type in the BASIC part of the program as shown in Listing 3.

To save memory space, all the variables used in the program must be assigned in immediate mode; this will also enable us to find the start of the screen address in the very beginning of the program. The value and name of each variable is shown in Table 1.

To RUN the program, simply type GOTO 10 and you'll see a board similar to that shown in

```
 1 2 3 4 5 6 7 8
 + + + + + + + + 1
 + + + + + + + + 2
 + + + + + + + + 3
 + + + X O + + + 4
 + + + O X + + + 5
 + + + + + + + + 6
 + + + + + + + + 7
 + + + + + + + + 8

 X  0 2    >O  2 0
```

Fig. 1. A graphic illustration of what you should see on the screen.

Program description

Lines	Description
10	– Activates the machine code program.
20-30	– Assign the number of pieces each player has when the game starts.
35	– The finding of the starting address of the display file.
40	– POKEs the number of pieces each player has.
50-51	– POKE the arrow head on the screen indicating whose turn it is.
52	– INPUTs the move.
53	– Checks to see if a player wants to give up their turn.
55	– Initializes the sub-total of the move.
60	– Finds out the address of the player's choice.
70	– Checks to see if that address is being occupied by other pieces.
90-180	– The checking routine for finding whether the move is legal.
190	– If the sub-total of that move is zero then the player must input another move.
200	– Changes to another player's turn.
210	– POKEs the number of pieces each player has on the screen and waits for another move.
1000-1080	– The flipping routine to find out the number of pieces flipped in that direction.
1090-1100	– Reads the number of pieces each player has.
1110	– Goes back to check another direction.
2000-2030	– POKE the number of pieces on the screen.
2035	– Checks to see if the board is full.

Fig. 1. Notice the arrow head indicating which player is next to play and the number of pieces each player has placed on the screen.

In the move

To move, you type in the coordinates as a single number; for example, if you wanted to place one of your pieces in the bottom right-hand corner, you would type in '18'. If the move is illegal, the arrow head will stay pointing to the player who made the illegal move and wait for a legal instruction. Once a legal move has been made, the arrow head will move to point at the other player's score.

If you cannot move, you should input '99' and the computer will automatically go to the next player's move. After each move, the number of pieces each player has placed will be re-adjusted and printed on the board.

The game will stop automatically when the board is full, but if neither player can move at any stage of the game you can type in a letter and stop the game.

```
1   REM (112 As)
10  LET B=O
20  FOR A=16427 TO
16538
30  INPUT C
40  POKE A,C
50  PRINT A,C,
60  LET B=B+C
70  NEXT A
```

Listing 1. The BASIC program to enter the machine code.

Address	Statement	Code
16427	LD HL(16396)	42,12,64,
16430	INC HL	35,
16431	LD D,H	84,
16432	LD E,L	93,
16433	LD A,28	62,28,
16435	LD B,9	6,9,
16437	LD(HL),0	54,0,
16439	INC HL	35,
16440	PUSH BC	197,
16441	LD B,8	6,8,
16443	LD(HL),19	54,19,
16445	INC HL	35,
16446	DJNZ E(41)	16,251,
16448	LD(DE),A	18,
16449	LD(HL),A	119,
16450	INC DE	19,
16451	INC HL	35,
16452	INC A	60,
16453	LD(HL),117	54,117,
16455	INC(HL)	52,
16456	INC HL	35,
16457	POP BC	193,
16458	DJNZ E(37)	16,233,
16460	LD B,2	6,2,
16462	PUSH BC	197,
16463	LD B,10	6,10,
16465	LD(HL),0	54,0,
16467	INC HL	35,
16468	DJNZ E(63)	16,251,
16470	LD(HL),117	54,117,
16472	INC (HL)	52,
16473	INC HL	35,
16474	POP BC	193,
16475	DJNZ E(60)	16,241,
16477	LD(16398),HL	34,14,64,
16480	LD(16400),HL	34,16,64,
16483	LD A,12	62,12,
16485	LD(16421),A	50,37,64,
16488	LD DE,16515	17,131,64,
16491	LD B,8	6,8,
16493	LD HL,(16396)	42,12,64,
16496	PUSH BC	197,
16497	LD(16503),DE	237,83,119,64,
16501	LD BC,1	237,75,152,64,
16505	ADD HL,BC	9,
16506	INC DE	19,
16507	INC DE	19,
16508	LD A,(DE)	26,
16509	LD(HL),A	119,
16510	INC DE	19,
16511	POP BC	193,
16512	DJNZ E(16493)	16,235,
16514	RET	201,
16515		1,
16516		0,
16517		0,
16518		10,
16519		0,
16520		0,
16521		49,
16522		0,
16523		61,
16524		50,
16525		0,
16526		52,
16527		60,
16528		0,
16529		52,
16530		61,
16531		0,
16532		61,
16533		111,
16534		0,
16535		61,
16536		120,
16537		0,
16538		52,

Listing 2. The machine code part of the Reversi program.

```
10   RANDOMISE USR(16427)
20   LET F(0)=2
30   LET F(1)=2
35   LET M=PEEK(16396)+PEEK(16397)*256
40   GO SUB 2000
50   POKE M+114-3*(C=1),23-(C=0)
51   POKE M+114-3*(C=0),0
52   INPUT X
53   IF X=99 THEN GO TO 200
55   LET ST=0
60   LET P=(X*(X/10)*10)*11+1+X/10
70   IF NOT PEEK(M+P)=19 THEN GO TO 52
90   FOR X=1 TO 8
92   LET X1=P
95   LET T=0
100  LET X1=X1+D(X)
110  IF NOT PEEK(M+X1)=A(-(C-1)) THEN GO TO 120
112  LET T=T+1
114  GO TO 100
120  IF PEEK(M+X1)=A(C) THEN GO TO 1000
180  NEXT X
190  IF ST=0 THEN GO TO 52
200  LET C=-(C-1)
210  GO TO 40
1000 IF T=0 THEN GO TO 180
1005 LET X1=P
1010 POKE M+X1,A(C)
1020 IF ST >0 THEN GO TO 1030
1025 LET F(C)=F(C)+1
1030 FOR A=1 TO T
1060 LET X1=X1+D(X)
1070 POKE M+X1,A(C)
1080 NEXT A
1090 LET F(C)=F(C)+T
1100 LET F(-(C-1))=F(-(C-1))-T
1105 LET ST=ST+T
1110 GO TO 180
2000 FOR A=0 TO 1
2005 POKE M+112+(A=1)*-6,F(A)/10+28
2010 POKE M+113+(A=1)*-6,F(A)-(F(A)/10)*10+28
2030 NEXT A
2035 IF F(0)+F(1)=64 THEN STOP
2040 RETURN
```

Listing 3. The main part of the listing.

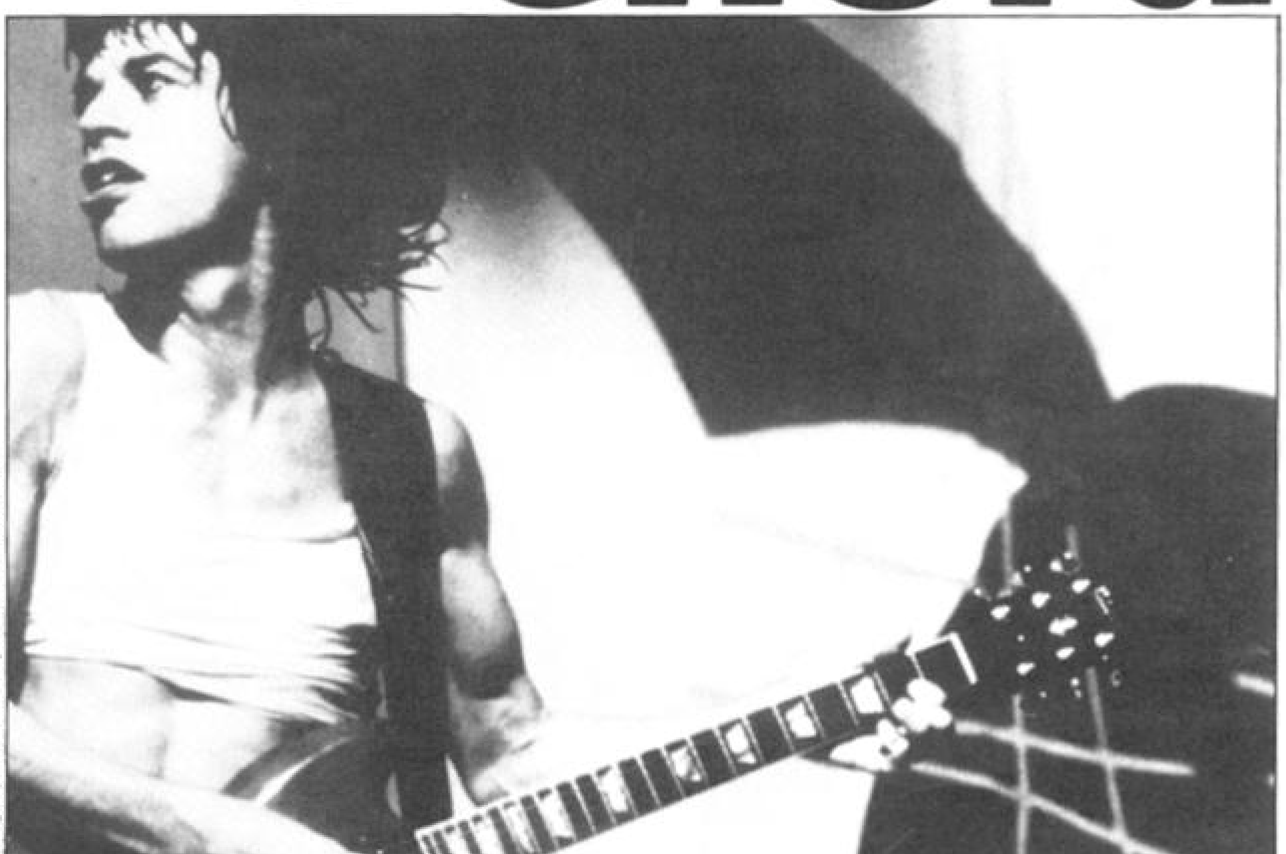
Name	Description
DIM F(1)	The number of pieces each player has.
LET M=0	The start of the screen address.
LET C=0	The number of player, can be zero or one.
LET X=0	The move of each player.
LET ST=0	The sub-total of the move.
LET P=0	The position in which the player is moved.
LET X1=0	The variable representing P.
LET T=0	The number of opponent's pieces in one particular direction.
DIM D(8)	The change of address in each of the eight directions.
LET D(1)=1	
LET D(2)=-10	
LET D(3)=-11	
LET D(4)=-12	
LET D(5)=-1	
LET D(6)=10	
LET D(7)=11	
LET D(8)=12	

Table 1. The variables used in the program, Reversi.



Having difficulty getting your fingers around those tricky guitar chords! Bring your ZX81 into play with this program from C A Read of Swansea.

Striking the right chord



Photograph courtesy of EMI Records.

When RUN, this program draws a simulation of a guitar neck and asks the user to input a number corresponding to the particular chord you wish to see on the screen.

Getting in tune . . .

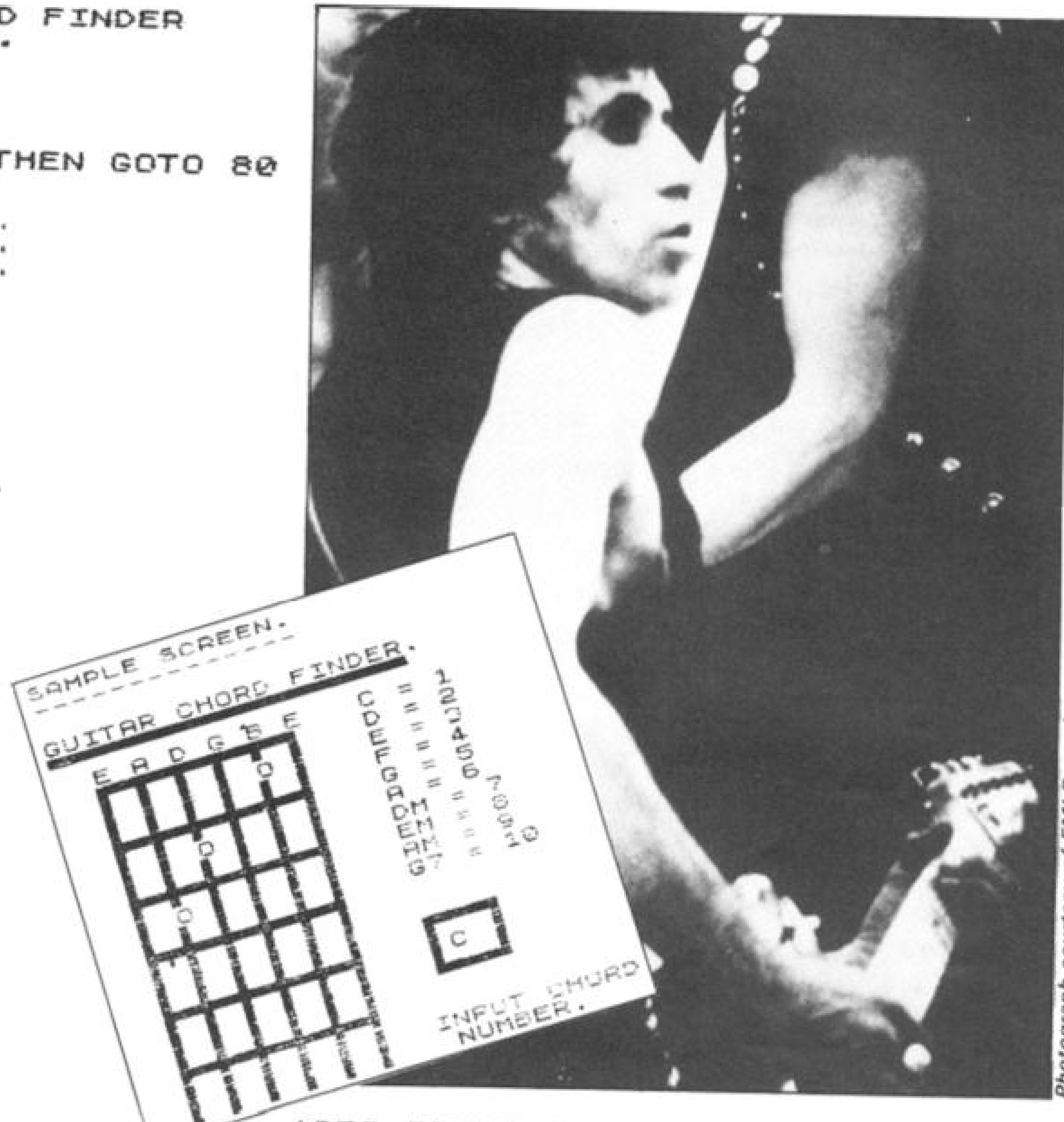
The program asks the user to input a number one to ten and then the chord corresponding to the number will be displayed with the relevant finger positions. The chord name is displayed in a box beside the diagram and the program then waits for a further input.

You could add two more chords to the published program by changing line 82 to read:

```
82 IF C<1 OR C>12 THEN
GOTO 80
```

and enter the co-ordinates for the new chords in the subroutines at lines 5500 and 6000. Then, you would have to alter the menu in line 7065. The chords included in the program as it stands are C, D, E, F, G, A, Dm, Em, Am and G7.

Now if only someone could write a program to tune the guitar . . .



Photograph courtesy of EMI Records.

```
  10 REM GUITAR CHORD FINDER
  15 REM BY C.A.READ.
  20 LET X=15
  30 LET Y=17
  40 GOSUB 7000
  80 INPUT C
  82 IF C<1 OR C>10 THEN GOTO 80
  85 GOSUB 7000
  90 GOSUB C*500
 100 PRINT AT A,B;"O"
 110 PRINT AT C,D;"O"
 120 PRINT AT E,F;"O"
 130 GOTO 80
 490 REM C CHORD
 500 LET A=4
 510 LET B=10
 520 LET C=7
 530 LET D=6
 540 LET E=10
 550 LET F=4
 560 PRINT AT X,Y;"C"
 570 RETURN
 990 REM D CHORD
1000 LET A=7
1010 LET B=8
1020 LET C=10
1030 LET D=10
1040 LET E=7
1050 LET F=12
1060 PRINT AT X,Y;"D"
1070 RETURN
1500 REM E CHORD
1510 LET A=7
1520 LET B=4
1530 LET C=7
1540 LET D=6
1550 LET E=4
1560 LET F=8
1570 PRINT AT X,Y;"E"
1580 RETURN
2000 REM F CHORD
2010 LET A=10
2020 LET B=6
2030 LET C=7
2040 LET D=8
2050 LET E=4
2060 LET F=10
2070 PRINT AT 4,12;"O"
2080 PRINT AT X,Y;"F"
2090 RETURN
2500 REM G CHORD
2510 LET A=10
2520 LET B=2
2530 LET C=7
2540 LET D=4
2550 LET E=10
2560 LET F=12
2570 PRINT AT X,Y;"G"
2580 RETURN
3000 REM A CHORD
3010 LET A=7
3020 LET B=6
3030 LET C=7
3040 LET D=8
3050 LET E=7
3060 LET F=10
3070 PRINT AT X,Y;"A"
3080 RETURN
3500 REM DM CHORD
3510 LET A=7
3520 LET B=8
3530 LET C=10
3540 LET D=10
3550 LET E=4
3560 LET F=12
3570 PRINT AT X,Y;"DM"
3580 RETURN
4000 REM EM CHORD
4010 LET A=7
4020 LET B=4
4030 LET C=7
4040 LET D=6
4050 LET E=7
4060 LET F=6
4070 PRINT AT X,Y;"EM"
4080 RETURN
4500 REM AM CHORD
4510 LET A=7
4520 LET B=6
4530 LET C=7
4540 LET D=8
4550 LET E=4
4560 LET F=10
4570 PRINT AT X,Y;"AM"
4580 RETURN
5000 REM G7 CHORD
5010 LET A=10
5020 LET B=2
5030 LET C=7
5040 LET D=4
5050 LET E=4
5060 LET F=12
5070 PRINT AT X,Y;"G7"
5080 RETURN
7000 PRINT AT 0,0;"GUITAR CHORD
FINDER."
7010 PRINT "▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀▀"
7015 PRINT "  E A D G B E"
7020 FOR T=1 TO 6
7030 PRINT "   ▛▀▀▀▀▀▀▀▀▀▀▀▀▜"
7040 PRINT "   ▌ ▌ ▌ ▌ ▌ ▌ ▌"
7050 PRINT "   ▌ ▌ ▌ ▌ ▌ ▌ ▌"
7060 NEXT T
7065 PRINT AT 2,16;"C = 1",,"D =
2",,"E = 3",,"F = 4",,"G = 5",,
"A = 6",,"DM = 7",,"EM = 8",,"AM
= 9",,"G7 = 10"
7070 PRINT AT 19,15;"INPUT CHORD
",,"NUMBER."
7080 PRINT AT 14,16;"▛▀▀▜",,"▌
 ▌",,"▙▄▄▟"
7090 RETURN
```

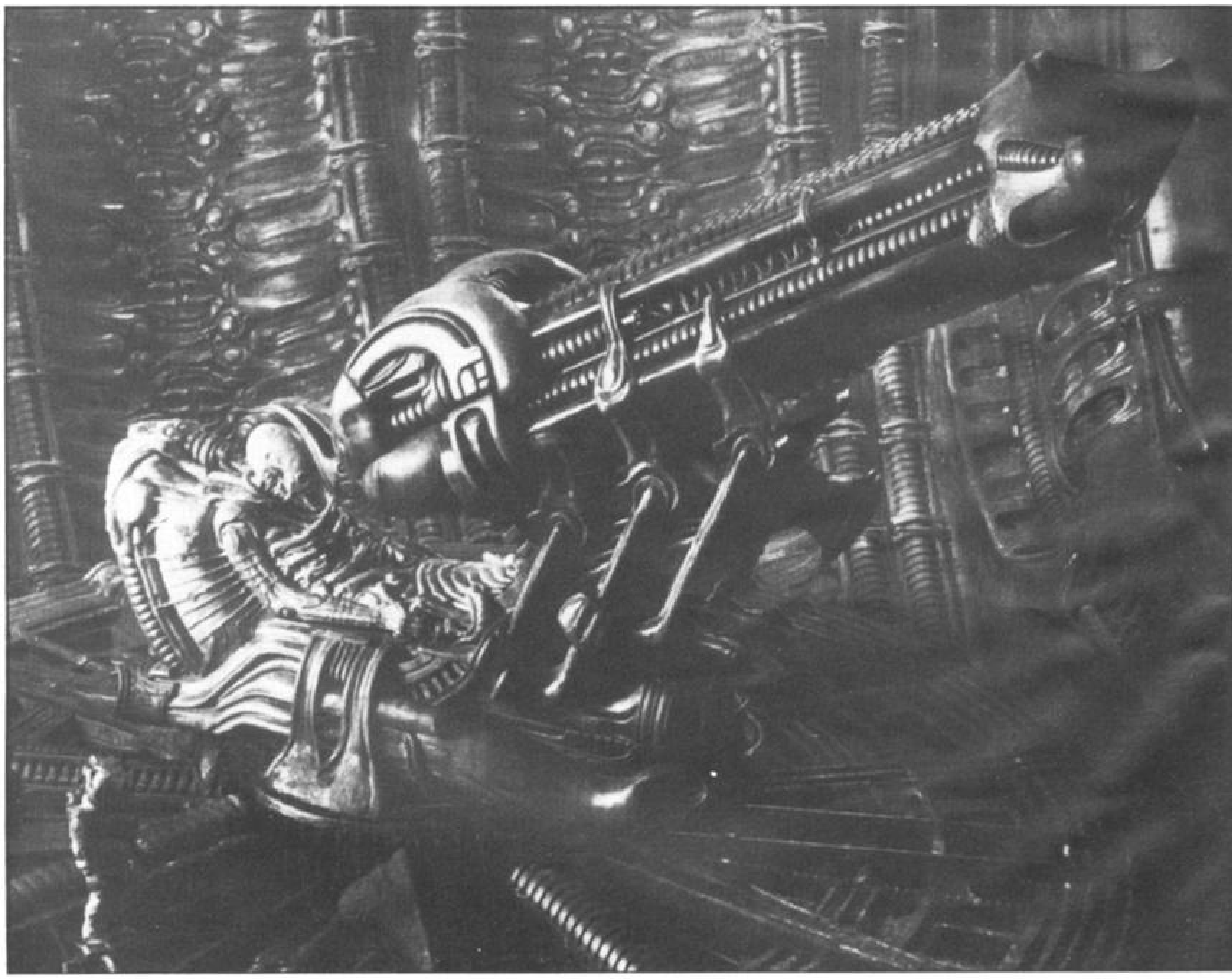
Aliens

Can you defend the Earth from the invading aliens in this game written for us by Andrew Cole of Burnley?

In this game for your 16K Spectrum, you command a missile base which you can manoeuver along the surface of the Earth, using the 'p' key to move right and the 'o' key to move left. To fire a missile you have to press the 'q' key.

The aliens, in their usual unfriendly way, re-energise at different levels above the Earth one at a time. It is your job to shoot them out of the sky before they get enough ships out of hyperspace to destroy the Earth. Once they have 10 ships positioned over the surface, they will be in a position to do this. So, your mission, should you choose to accept it, is to keep the number of aliens in the sky down to less than 10.

You can only fire one missile at a time on-screen, but if you find it too difficult to play at one level, you can always choose another — there are five skill levels in all.

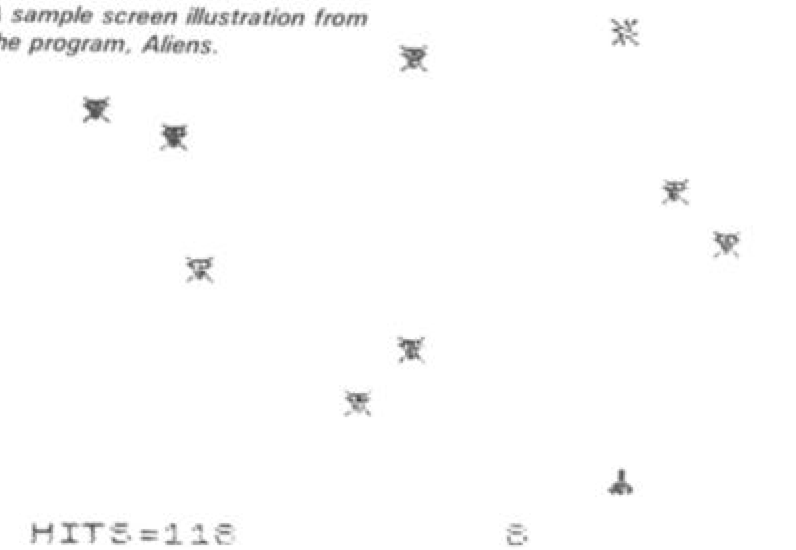


Photograph courtesy of 20th Century-Fox Corp.




```
  10 GO SUB 1000
  20 GO SUB 1200
  30 REM screen setup
  35 BORDER 0
  40 CLS : PRINT AT 20,2; PAPER
4;"
"
  45 PRINT AT 21,2; PAPER 4;"
"
  50 FOR s=1 TO 20
  60 PLOT RND*254,RND*120+40
  70 NEXT s
  80 LET f1=0: LET l=15
  90 LET z=0: LET hits=0
 100 REM aliens
 110 POKE 23672,0
 120 LET t=PEEK 23672
 130 IF t>=80-(a*6) THEN PRINT A
T RND*17,RND*26-2; INK 2;"A": LE
T z=z+1
 140 IF z=10 THEN GO TO 400
 150 PRINT AT 21,21;z
 160 IF t>=80-(a*6) THEN POKE 23
672,0
 200 REM laser base
 205 LET l=l+(INKEY$="p")-(INKEY
$="o")
 210 LET l=l+(l=0)-(l=30)
 220 PRINT AT 19,l;" L ": PAUSE
4
 230 IF INKEY$="q" THEN GO TO 25
0
 240 IF INKEY$<>"q" THEN GO TO 1
20
 250 FOR c=18 TO 0 STEP -1
 260 PRINT AT c,l+1;"D": PAUSE 2
 270 PRINT AT c,l+1;" "
 275 IF ATTR (c-1,l+1)=58 THEN G
O TO 300
 280 NEXT c
 290 GO TO 130
 300 REM missile hit
 310 BEEP .1,z*2
 320 LET z=z-1: PRINT AT 21,21;z
 330 PRINT AT c-1,l+1; FLASH 1;"
E": PAUSE 50
 340 PRINT AT c-1,l+1;" "
 350 LET hits=hits+1
 360 PRINT AT 21,3;"HITS=";hits
 370 GO TO 130
 400 PRINT AT 4,8; INK 0; FLASH
1;"YOU'RE DEAD"
 410 PRINT AT 12,3;"Do you want
another game y/n"
 420 IF INKEY$="y" THEN GO TO 20
 430 IF INKEY$="n" THEN STOP
 440 GO TO 420
1000 FOR n=0 TO 7
1010 READ a: POKE USR "a"+n,a
1020 NEXT n
1030 DATA 129,126,219,126,60,60,
90,129
1040 FOR n=0 TO 7
1050 READ l: POKE USR "l"+n,l
1060 NEXT n
1070 DATA 24,24,24,24,60,126,255
,90
1080 FOR n=0 TO 7
1090 READ d: POKE USR "d"+n,d
1100 NEXT n
1110 DATA 16,16,16,16,16,16,56,4
0
1120 FOR n=0 TO 7
1130 READ e: POKE USR "e"+n,e
1140 NEXT n
1150 DATA 137,74,52,204,51,44,82
,145
```

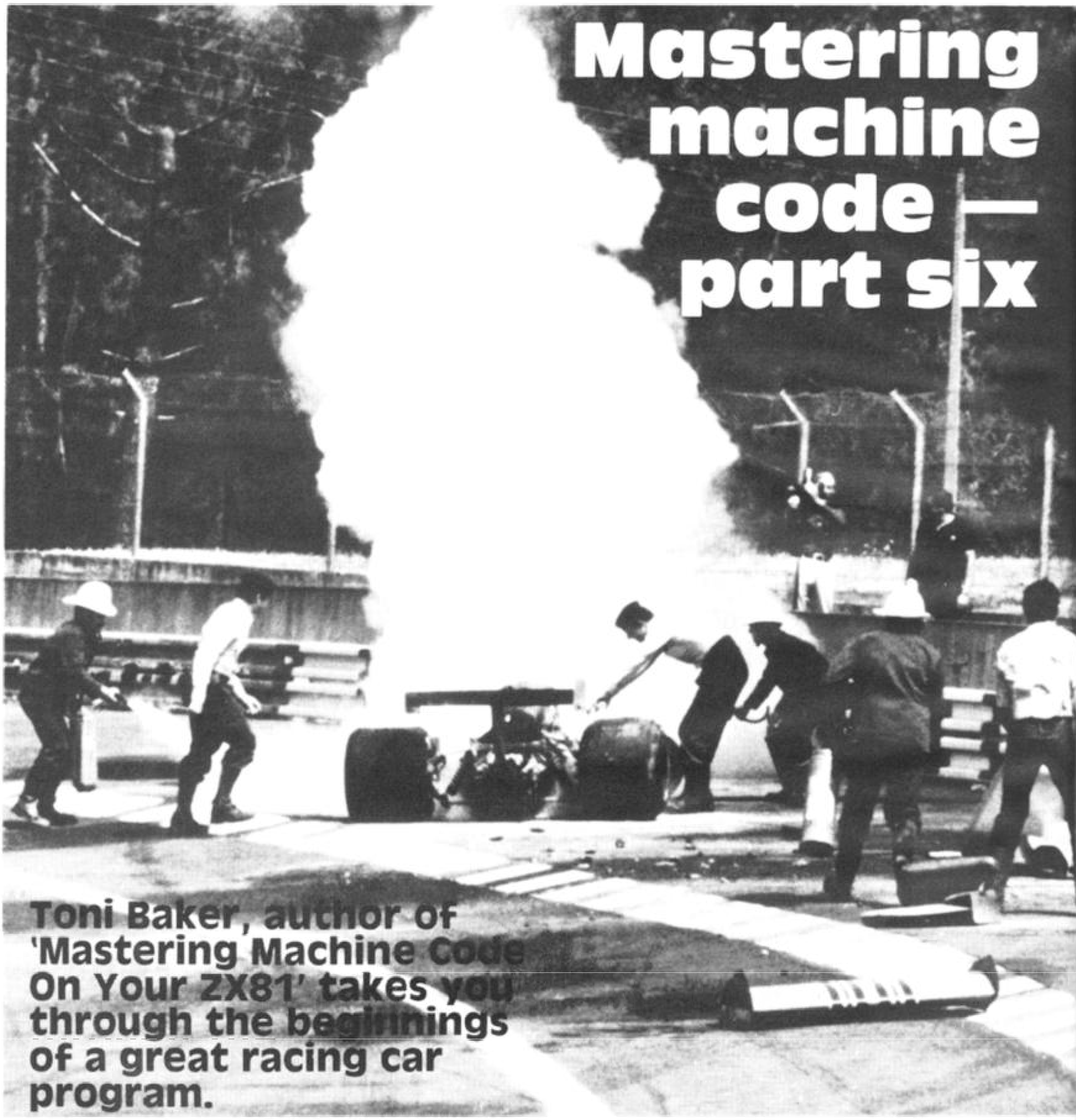
A sample screen illustration from the program, Aliens.




```
1160 RETURN
1200 REM instructions
1210 PRINT AT 3,3;"You have to d
efend yourself     against the at
tacking aliens     who will re-en
ergise out of      hyperspace abo
ve the ground.       It is your jo
b to shoot the      aliens down us
ing your laser      base "
1220 PRINT AT 16,3;"PRESS ANY KE
Y TO CONTINUE"
1230 IF INKEY$=" " THEN GO TO 12
50
1240 PAUSE 0
1250 CLS : PRINT AT 3,3;"Your la
ser base is controlled    by keys
'o' for left,'p' for      right a
nd 'q' for fire.           If you
allow 10 aliens to be     present
 at the same time you      will be
 eliminated"
1260 PRINT AT 13,2;"SELECT SKILL
 LEVEL FROM 1-5"
1270 PRINT AT 15,5;"1=EASIEST   5
=HARDEST"
1280 LET a$=INKEY$
1290 INPUT "SKILL LEVEL= ";a$
1300 IF a$<"1" OR a$>"5" THEN GO
 TO 1280
1310 LET a=VAL a$
1320 RETURN
```

Photograph courtesy of 20th Century-Fox Corp.

Mastering machine code — part six



Toni Baker, author of 'Mastering Machine Code On Your ZX81' takes you through the beginnings of a great racing car program.

In this article I would like to concentrate on the very basic question of *how to write a program.* That is, given an idea, how do we change that idea into byte by byte reality? There's no real algorithm for it — it's an intuitive process. If there *was* an algorithm for it then we could write a computer program to do it for us. Imagine how great that would be. We could feed in the information "CHESS: Board Game, 8x8; starting position; rules" and the program would output a chess program for us! No such luck in real life. Writing programs is an abstract, not a logical process — lateral rather than linear.

Lateral thinking is a skill which all of us, as human beings, posess. Lateral thinking is different from linear thinking. In linear thinking, one idea leads to another, which leads to another, which leads to another, until eventually you reach a conclusion. Computer programs *can* be written to follow this kind of thinking, and those which do may be defined as 'intelligent'; however, nobody yet has devised a program which uses lateral logic — this is when you abandon one train of thought and decide to try a different approach. This new train of thought comes into your head spontaneously and you cannot pinpoint exactly where the idea came from. Artists and songwriters create their works in their heads almost entirely by lateral thinking (well, the best of them anyway) and this process they will describe as 'inspiration' or 'intuition'. *Intuition* then, is the basic ingredient in the writing of a sucessful computer program from scratch.

Thanks for the memory

Memory (human memory, not

computer memory) is another basic ingredient. This is known in the trade as 'experience'. Experience, however, is not paramount (for if it was then the first ever program wouldn't have been written). Experience can be replaced by immediate access to knowledge in other forms. An experienced programmer may know instinctively that the Hex 09 means ADD HL, BC and that to LPRINT a character all you have to do is set bit one of FLAGS and then use RST 10, whereas everyone else will need to look these things up. I must stress that this is not a handicap as long as you do have the information (usually in book form) immediately to hand. Experienced people may write *better* (and by that I mean more sophisticated) programs than beginners, but this is only because they have immediate access to more sophisticated blocks of knowledge — "Oh yes, I know the best way to scroll the screen sideways two squares with a double somersault in between because I did it last Thursday for the program to make toasted cheese sandwiches out of five unknown variables". I wouldn't worry too much about it. That routine may be to hand now, but even the experienced had to write it for the first time once, and believe me it took them a very long time (not to mention hours of lost sleep) to get it working.

The *sophistication* of the program then, is what is determined by experience. The beginner should not attempt to write a chess program. The experienced programmer would laugh at the idea of writing anything as trivial as a program to turn the screen blue. You must compromise the kind of program you want to write with what you know you can achieve. Every program you write should fall somewhere between the limits 'simple' and 'very hard'. These words obviously mean different things to different people, so judge by the following convention: a 'simple' program is one that takes *you* less than two days to complete, and a 'very hard' program is one that takes *you* over a month. Programs which you think are going to take you much much longer than even that fall into the category 'impossible' and should not be attempted, as they usually result merely in the breaking of a few items of furniture.

On display

The 'format' of the screen display is something else which improves with experience. The intricacy of the picture — the 'flowerification' as someone I know would say. A beginner would use screen displays constructed out of characters from the Spectrum character set, then as you advance you will find yourself using user-defined graphics (up to 21) and then even more user-defined graphics (any unlimited number), and finally dispense with the graphics altogether and just POKE into the memory to obtain the ultimate in high resoluteness.

Let's program then. First the idea, then the solution. The idea is a racing car program. It's not an original idea — I stole it from a video game I once saw. (It's not illegal to steal the *idea* for a video game as long as you write the actual program yourself from scratch.) The game plays as follows: given a steering wheel (or in this case two buttons) and an accelerator to control your speed, you must perform one lap of a specific race track faster than your opponent (the computer). Your opponent is a perfect driver and will never crash, however, this is only because they maintain a constant and fairly medium speed. You on the other hand must compromise between travelling slowly but safely (and losing the race) or going for speed in order to win (whilst trying not to crash).

Now here's where intuition/experience bit comes in. I, as an experienced so and so, happen to know offhand that there is a subroutine in the ROM which will scroll part of the screen upwards, but that there is *not* a subroutine in the ROM which will scroll part of the screen downwards. Because I can't be bothered to write one I conclude that it would be easier to have the car at the top of the screen with the road scrolling upwards toward the car.

Answers, answers

The solution is that we can resort to an alogorithm-type approach just a little here. The first step in almost any video game is called initialisation, and this usually consists of two parts: (i) initialising any variables needed; and (ii) initialising the image on the screen. We can't really think about variables just yet because we don't know what we're going to need — so to the screen.

Here we rely on intuition and artistic ability. We have total control over what we want the image to look like, remember, and so we need imagination to decide on how we want it. My suggested process, written first in BASIC, is shown in Fig. 1.

If you feed in this program you should see a yellow information window (yes, that's what it's called!) above the start of a racetrack on which are drawn a blue human's car and a red computer's car.

To turn this part into machine code is very simple. We need two strings as data: one for the string in line 10, and one for the string in line 50. So in other words, one way to start the program could be:

```
11065468 STR_1
DEFM PAPER yellow

16050A8E STR_2
DEFM AT 5,10d graphic
shift 1
```

```
10  PRINT PAPER 6;"Time four spaces Distance four
    spaces Distance twelve spaces to go (H) three spaces
    to go (C) three spaces" ,," = = = = = = = = = = = = =
    = = = = = = = = = = = = = = = = = = ="
20  FOR i=1 TO 17
30  PRINT TAB 7;"graphic shift 8" ;TAB 24;"graphic shift
    8"
40  NEXT I
50  PRINT AT 5,10; INK 1;"graphic shift 1 graphic shift 2
    inverse C graphic shift 1 graphic shift 2 two spaces";
    INK 2;"graphic shift 1 graphic shift 2 inverse H
    graphic shift 1 graphic shift 2"
```

Fig. 1.

Notice the special bytes in the strings. Byte 11 means 'PAPER', and so the two bytes 1106 together means PAPER 6. Similarly the byte 16 means 'AT', and so the bytes 16050A together mean AT 5,10. Comma separators may be replaced by the byte 06, and apostrophe separators by OD. All of these are listed in Appendix A of the Spectrum manual. A third string is also needed for the FOR. . .NEXT loop. See if you can work out what it translates to in Hex. (Warning: TAB x translates to 17xx00, not to 17xx as you'd expect!) The text needed is as in line 30.

In the machine code version, the first string should *end* in PAPER white, which was not necessary in the BASIC version.

Last stage

And so to business. To print one of these strings the procedure is as follows: load BC with the length of the string, and DE with the address of the first byte, and then CALL 103C. Thus, the BASIC may be replaced entirely by the code in Fig. 2. The initialisation of the screen complete, the next stage is to look closely at the rest of the game. This is actually easier than it sounds. Given that there is a subroutine in the ROM which will scroll all but the top five inches of screen upwards, see if you can figure out for yourself how the rest of the program will work. This is where I effectively test *your* intuition and lateral thinking ability. I'm not simply going to leave it at that, of course, but I *am* going to wait until the next article before I carry on. In the meantime I would like you to stretch your brains a bit trying to decide for yourself more or less what answer I'm eventually going to come up with. (Good game this, isn't it?) I *will* complete this program next issue. Till then, keep up the good work.

```
01????             LD BC, length of string one.
11????             LD DE, address of string one.
CD3C20             CALL PR_STRING
0611               LD B, 17d
C5         LOOP    PUSH BC
01????             LD BC,length of string three.
11????             LD DE,address of string three.
CD3C20             CALL PR_STRING
C1                 POP BC
10F3               DJNZ LOOP
01????             LD BC,length of string two.
11????             LD DE, length of string two.
CD3C20             CALL PR_STRING
```

Fig. 2.

Naught but a game!



The classic game of Naughts and Crosses for your ZX81, courtesy of SP Stratford of Hemel Hempstead.



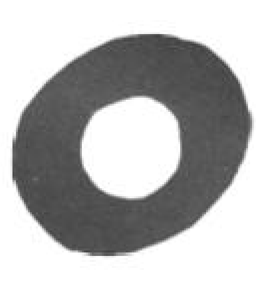
This program has the ZX81 playing a pretty mean game of Naughts and Crosses against a willing opponent. The program requires about 7K of RAM to operate.

In this game you are the 'naughts' and the computer is the 'crosses'. The program is divided into several parts:

DRAWC	— Draws the computer's piece.
DRAWP	— Draws the player's piece.
WIN	— Checks to see if someone has won or if it is a draw.
COMP	— The computer's move.
PLAYER	— The player's move.
CLEAR	— Clears the player's prompts.
GRID	— Prints the playing grid.



Each part of the program is called by the GOSUB command, for example GOSUB COMP is the subroutine for the computer's moves.



Three in a row

The following is a brief guide to some of the more important lines in the program:

5005-5020	Find if one of the players has a row of three counters.
5200	The player gets two points for each win.
5320	The ZX81 gets five points for each win.
6005-6008	Work out the average value of RND.
8002	Ensures the print position is in the top left-hand corner.
8200-8210	Make sure that the scores do not run onto the board.

```
   1 SAVE "O"
   2 SLOW
   3 REM * 7K R.A.M. AT LEAST *
   4 RAND 0
   5 PRINT TAB 9;"NOUGHTS";AT 2,
11;"AND";AT 4,9;"CROSSES"
   6 PRINT AT 6,2;"■■■";AT 7,2;"
■ ■";TAB 9;"THIS IS YOUR PIECE";
AT 8,2;"■■■"
   7 PRINT AT 11,2;"■";TAB 4;"■"
;TAB 3;"■";TAB 9;"THIS IS THE ZX
-81 PIECE";TAB 2;"■ ■"
   0■PRINT AT 21,2;"(C) S.P.STRA
TFORD, 28/11/82"
   9 PRINT AT 16,0;"**** PRESS N
EWLINE TO START ****";AT 16,0;"*
*** PRESS NEWLINE TO START ****"
  10 IF CODE INKEY$<>118 THEN GO
TO 9
  15 GOSUB 9000
  19 CLS
  20 LET GOES=0
  21 FOR U=1 TO 3
  22 FOR P=1 TO 3
  23 LET A(P,U)=0
  24 NEXT P
  25 NEXT U
  26 GOSUB GRID
  30 PRINT AT 11,1;"DO YOU";AT 1
2,1;"WISH TO";AT 13,1;"GO FIRST?
";AT 14,2;"Y OR N."
  40 LET A$=INKEY$
  50 IF A$="N" THEN GOTO 110
  60 IF A$<>"Y" THEN GOTO 40
  90 GOSUB PLAYER
 100 GOSUB WIN
 105 GOSUB DRAWP
 110 GOSUB COMP
 115 LET GOES=GOES+1
 120 GOSUB WIN
 130 GOSUB DRAWC
 140 GOTO 90
 999 REM
1000 REM  PLAYERS PIECES
1001 REM
1010 LET U$="■■■"
1020 PRINT AT YP1-1,XP1-1;U$;AT
YP1+1,XP1-1;U$;AT YP1,XP1-1;U$(1
);AT YP1,XP1+1;U$(1)
1030 RETURN
1499 REM
1500 REM  ZX-81 PIECES
1501 REM
1510 LET U$="■"
1520 PRINT AT YC1-1,XC1-1;U$;AT
YC1-1,XC1+1;U$;AT YC1,XC1;U$;AT
YC1+1,XC1-1;U$;AT YC1+1,XC1+1;U$
1530 RETURN
1999 REM
2000 REM  CLEAR SCREEN
2001 REM
2005 LET U$="
                 "
2010 FOR Z=10 TO 21
2020 IF Z<=16 THEN PRINT AT Z,0;
U$( TO 11)
2030 IF Z>16 THEN PRINT AT Z,0;U
$
2040 NEXT Z
2050 RETURN
2999 REM
3000 REM  PLAYER MOVE
3001 REM
3010 GOSUB CLEAR
3020 PRINT AT 11,1;" TO ";AT 12,
1;"WHERE";AT 14,3;"?"
3040 LET A$=INKEY$
3050 IF A$<"1" OR A$>"3" THEN GO
TO 3040
3060 LET XP=VAL A$
3070 PRINT AT 14,3;XP;AT 16,2;"A
ND";AT 18,3;"?"
3080 LET A$=INKEY$
3090 IF A$<"1" OR A$>"3" THEN GO
TO 3080
```

```
3100 LET YP=VAL A$
3110 PRINT AT 18,3;YP
3115 IF A(XP,YP)<>0 THEN GOTO 30
10
3120 IF XP=1 THEN LET XP1=14
3130 IF XP=2 THEN LET XP1=19
3140 IF XP=3 THEN LET XP1=24
3150 IF YP=1 THEN LET YP1=3
3160 IF YP=2 THEN LET YP1=8
3170 IF YP=3 THEN LET YP1=13
3180 GOSUB DRAWP
3190 LET A(XP,YP)=1
3200 RETURN
4999 REM
5000 REM  WINNER
5001 REM
5005 FOR V=1 TO 2
5010 IF (A(1,1)=V AND A(2,1)=V A
ND A(3,1)=V) OR (A(1,2)=V AND A(
2,2)=V AND A(3,2)=V) OR (A(1,3)=
V AND A(2,3)=V AND A(3,3)=V) OR
(A(1,1)=V AND A(1,2)=V AND A(1,3
)=V) OR (A(2,1)=V AND A(2,2)=V A
ND A(2,3)=V) OR (A(3,1)=V AND A(
3,2)=V AND A(3,3)=V) OR (A(1,1)=
V AND A(2,2)=V AND A(3,3)=V) OR
(A(3,1)=V AND A(2,2)=V AND A(1,3
)=V) THEN GOTO 5100+(100*V)
5020 NEXT V
5022 IF GOES<>9 THEN RETURN
5025 FOR Z=1 TO 100
5030 PRINT AT 19,2;"IT IS A DRAW
.WE BOTH GET";AT 20,9;"1 POINT."
5040 PRINT AT 19,2;"IT IS A DRAW
.WE BOTH GET";AT 20,9;"1 POINT."
5050 NEXT Z
5055 LET COMPW=COMPW+1
5056 LET HUMAN=HUMAN+1
5060 GOSUB CLEAR
5070 PRINT AT 18,2;"PRESS: C TO
CONTINUE,";AT 20,7;"SPACE BAR TO
 STOP."
5080 IF INKEY$<>"C" THEN GOTO 50
80
5090 CLS
5100 FOR O=1 TO 3
5101 FOR G=1 TO 3
5102 LET A(G,O)=0
5103 NEXT G
5104 NEXT O
5110 GOTO 20
5200 LET HUMAN=HUMAN+2
5205 FOR Z=1 TO 100
5210 PRINT AT 19,6;"YOU WIN 2 PO
INTS.";AT 19,6;"YOU WIN 2 POINTS
."
5215 NEXT Z
5220 GOSUB CLEAR
5230 GOTO 5070
5300 LET COMPW=COMPW+5
5310 FOR Z=1 TO 100
5320 PRINT AT 19,6;"I WIN 5 POIN
TS.";AT 19,6;"I WIN 5 POINTS."
5330 NEXT Z
5340 GOSUB CLEAR
5350 GOTO 5070
5999 REM
6000 REM  ZX-81 MOVES
6001 REM
6005 FOR B=1 TO 11
6006 LET WHERE=WHERE+RND
6007 NEXT B
6008 LET WHERE=WHERE/11
6010 IF WHERE<=.5 THEN GOTO 7000
6020 FOR T=1 TO 3
6030 FOR U=1 TO 3
6040 IF A(U,T)=0 THEN GOTO 6080
6050 NEXT U
6060 NEXT T
6065 GOTO 7000
6070 RETURN
6080 IF U=1 THEN LET XC1=14
6090 IF U=2 THEN LET XC1=19
6100 IF U=3 THEN LET XC1=24
6110 IF T=1 THEN LET YC1=3
6120 IF T=2 THEN LET YC1=8
6130 IF T=3 THEN LET YC1=13
6135 IF A(U,T)<>0 THEN GOTO 5000
6140 LET A(U,T)=2
6150 GOSUB DRAWC
6160 RETURN
7000 FOR T=1 TO 3
7001 FOR U=1 TO 3
7005 LET XC=INT (RND*3)+1
7010 LET YC=INT (RND*3)+1
7020 IF XC=0 OR XC>3 OR YC=0 OR
YC>3 THEN GOTO 7000
7030 IF A(XC,YC)=0 THEN GOTO 608
0
7039 NEXT U
7040 NEXT T
7050 GOTO 6020
7999 REM
8000 REM  GRID
8001 REM
8002 PRINT AT 0,0;
8010 PRINT "
"
8020 PRINT "   ZX-81
"
8030 PRINT "
"
8040 PRINT "   00000
"
8050 PRINT "
"
8060 PRINT "    YOU
"
8070 PRINT "
"
8080 PRINT "   00000
"
8090 PRINT "
"
8100 PRINT "-----------
"
8110 PRINT "
"
8120 PRINT "
"
8130 PRINT "
"
8140 PRINT "
"
8150 PRINT "
"
8160 PRINT "
"
8170 PRINT "
"
8200 LET H1=7-(LEN (STR$ COMPW))
8210 LET H2=7-(LEN (STR$ HUMAN))
8220 PRINT AT 3,H1;COMPW;AT 7,H2
;HUMAN
8240 RETURN
8999 REM
9000 REM  INITIALISE
9001 REM
9010 DIM A(3,3)
9020 FOR T=1 TO 3
9030 FOR Z=1 TO 3
9040 LET A(Z,T)=0
9050 NEXT Z
9060 NEXT T
9070 LET DRAWC=1500
9080 LET DRAWP=1000
9090 LET WIN=5000
9100 LET COMP=6000
9110 LET PLAYER=3000
9120 LET CLEAR=2000
9130 LET GRID=8000
9140 LET HUMAN=0
9150 LET COMPW=0
9160 LET GOES=0
9170 LET WHERE=0
9210 RETURN
```



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THE NEW FDS for the SPECTRUM, ZX81, LAZER 200, JUPITER ACE, and the ORIC as illustrated

This elegant desk top system, designed for the professional user. In its slimline case, the superior keyboard contains all the graphic characters for the above computers. With the additional function keys and SPACE-BAR, speedy and accurate data entry is made simple.

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The Master Unit provides all the requirements for the serious games enthusiast, containing not only the FULLER BOX, but also the FULLER ORATOR, all contained within the standard case.

The Speech Unit and sound synthesiser combines to provide exciting voice and sound for your games. The other features include, Cassette interface, a variable audio output which may be connected directly to a HI-FI system. The MASTER UNIT provides endless scope in applications, and it allows asccess to the SPECTRUM for other periferal, via its duplicate user port, i.e. printerface. The MASTER UNIT is complete with full documentation and demo tapes which includes the type of speech and sound you can achieve.

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The FULLER BOX added to the ZX Spectrum, improves the sound quality enormously. The built-in audio amplifier working well with all SPECTRUM programs.
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The FULLER BOX is complete with full documentation and a demo tape which includes the type of sounds you can achieve. It also allows you to program your own sounds. Fitting neatly onto the back of the SPECTRUM, the FULLER BOX still allows access for other peripherals, including the new SPECTRUM Micro Drives, via its duplicate user port.



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The graphics solutio

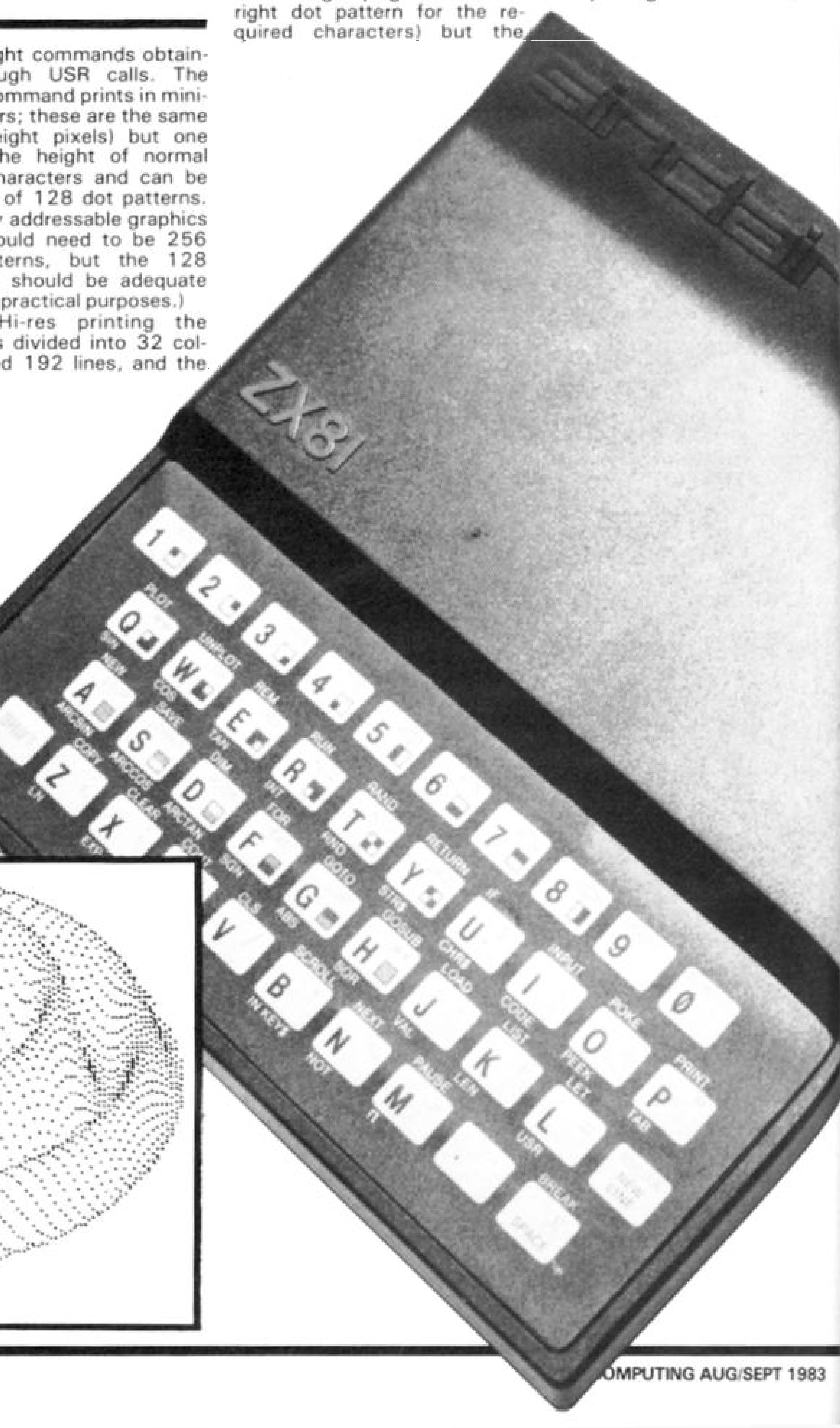
Nick Pearce looks at a couple of ways to get high resolution graphics on your ZX81.

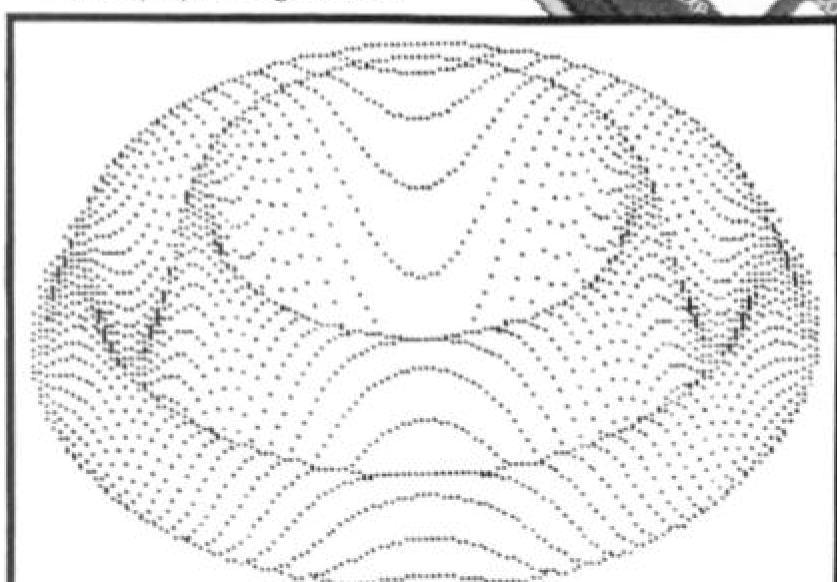
Owners of the ZX Spectrum will already be familiar with the delights of high resolution graphics. However, ZX81 owners (excepting those with the necessary hardware add-ons) have hitherto been denied that facility, although the excellent results sometimes obtained by enterprising programmers belie the limited graphics set available. High Resolution is a piece of software which goes some way towards remedying this deficiency enabling 256 by 192 resolution displays to be constructed. User-defined characters (lower case alphabet, chess pieces, space invaders, etc) and smooth curves are available using this software on your trusty ZX81 and 16K RAM Pack.

The cassette contains three programs: the high resolution toolkit itself, and two demonstration programs. Toolkit is held in a REM statement and occupies about ¾K of RAM. The Hi-res display file is about eight times as large as normal and is held above RAM-top, which must be lowered with the appropriate POKE command before LOADing — easily forgotten as I found to my cost!

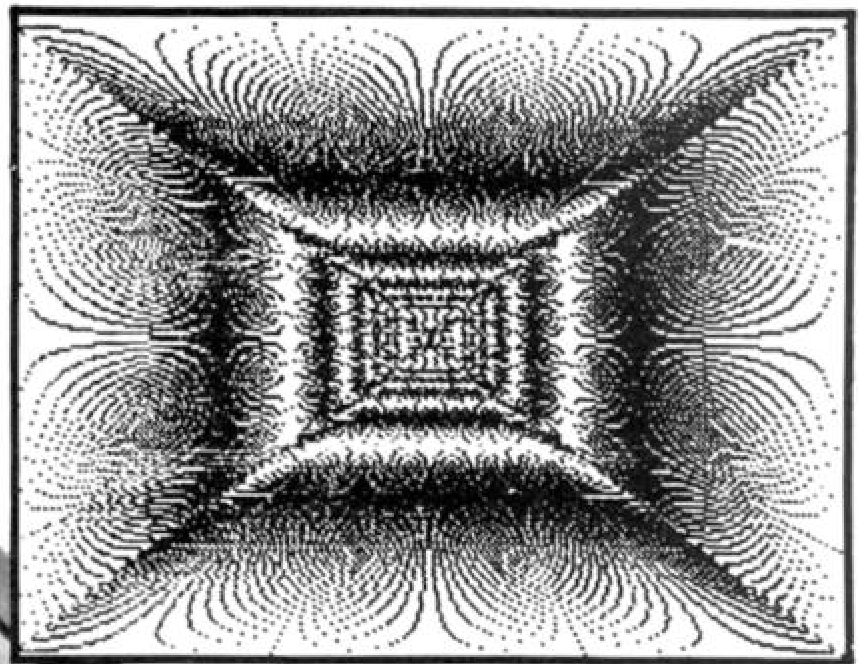
The displays are generated using eight commands obtained through USR calls. The PRINT command prints in mini-characters; these are the same width (eight pixels) but one eighth the height of normal ZX81 characters and can be any one of 128 dot patterns. (For truly addressable graphics there would need to be 256 dot patterns, but the 128 available should be adequate for most practical purposes.)

For Hi-res printing the screen is divided into 32 columns and 192 lines, and the procedure is to POKE the column number, line number and mini-character code into assigned memory locations from which they can be printed onto the screen. The method is a little tedious (it is particularly frustrating trying to find the right dot pattern for the required characters) but the results are worth the effort. Hi-res characters can be moved around the screen and so games featuring high resolution graphics are possible (movement is slow in BASIC, but could obviously be speeded up using machine code).





A sample screen illustration using Notting Dale Technology Centre's Graphics Pack.



▲ *An example screen dump using the G007 High Resolution Graphics Pack.*



The G007 High Resolution Graphics Pack from the Notting Dale Technology Centre.

The PLOT command gives access to the complete 256 by 192 pixels. Plotting is obtained in a similar fashion to printing; the column and line co-ordinates are POKEd, followed by a USR call to plot the screen pixel.

An instruction booklet is included with the package. This explains the various Hi-res comands and lists the mini-characters available and their codes — it also gives some examples of how high resolution graphics can be used and incorporated in BASIC programs. I felt the booklet could have been more comprehensive; the inexperienced programmer may find it a little inadequate.

I did not find the High Resolution package a particularly easy program to use, relying as it does on POKE commands and USR calls. However, experienced machine code buffs should not have any difficulty using it effectively.

Computer Rentals are to be congratulated for producing this high resolution software for the ZX81. Not perfect, but a commendable achievement.

High Resolution is priced at £5.95 from Computer Rentals, 140 Whitechapel Road, London E1.

G007 High Resolution Graphics Pack Notting Dale Technology Centre

The G007 is a very powerful piece of hardware for the ZX81. It provides true high resolution graphics which, together with a comprehensive range of graphics commands, gives features usually found only on quite advanced machines — such as line drawing and textured area filling.

The G007 commands are easy to use and have been achieved by extending the functions of some of the normal BASIC statements. Particularly versatile is the new PLOT command which is in the form PLOT n,x,y. The co-ordinates x and y specify a position on the 256 by 192 Hi-res screen; n is a new parameter which is used to select any one of the 115 separate functions.

Plot on . . .

To give an idea of the procedure and the facilities available, some examples are: PLOT 34,x,y draws a coarse dotted line from the previous plot position to co-ordinates x,y; PLOT 102,x,y draws a chain dotted line to co-ordinates x,y relative to the previous plot position; and PLOT 42,x,y fills the triangle between x,y and the two previous plot positions in black.

User-defined characters are also easily obtained. The G007 allows the 32 characters of the ZX81 from inverse 4 to inverse Z to be readily re-defined (the old inverse video characters can still be obtained since the Hi-res print mode allows characters to be printed in inverse video). To re-define a character, the eight binary numbers representing each row of eight pixels have to be worked out; these are then POKEd into the appropriate locations in the 'character table' in RAM.

The normal low resolution mode of the ZX81 is still available with the G007 in use, and the ZX81 may be freely switched between the two modes without losing the contents of either. The Hi-res display file takes about 6.4K of RAM. The Hi-res display can be copied onto the printer, and programs and displays can be SAVEd on cassette.

The unit comes with a comprehensive and very well-written manual which also gives a number of example programs. The G007 itself comes in an attractive black plastic case measuring about 17cm by 3cm by 6½cm and is contoured to fit snugly between the ZX81 and the 16K RAM Pack.

Powerful

This is a very powerful high resolution graphics pack. The commands have been well thought out and it is a pleasure to use. Once you have used it for a few programs you will wonder how you ever managed without it.

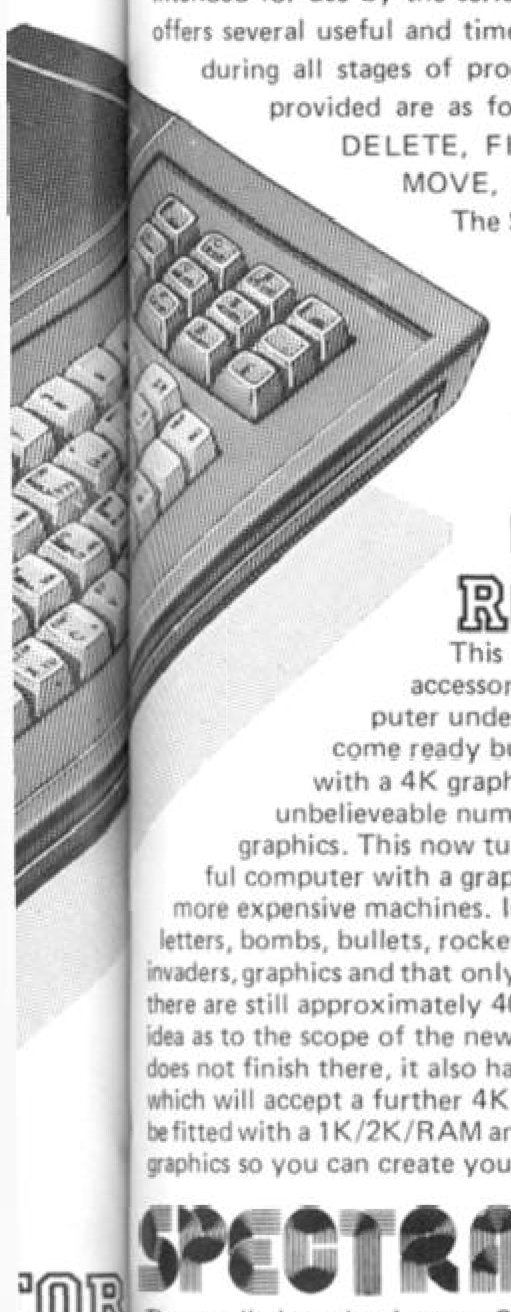
The problem for the ZX81 owner is considering hardware of this sort is whether to expand or to upgrade to obtain the desired facilities. Those who select the former option should find the G007 an excellent investment.

The G007 High Resolution Graphics Pack costs £32 excluding VAT (plus 75 pence P&P) from Notting Dale Technology Centre Ltd, TFL (ZX81), 189 Freston Road, London W10 6TH.

ZX 80/81 SPECTRUM HARDWARE

SPECTRUM/81 TOOLKIT BOTH AT ONLY £6.95

This is the toolkit which won acclaim in the feature in the August 1982 issue of Sinclair User. "It is the most impressive programm, fast in execution with clear and full instructions . . . . it stands out from the rest of the field". The ZXED is a powerful editor for use on the expanded ZX81. It is intended for use by the serious BASIC programmer and offers several useful and time saving features most helpful during all stages of program development. The facilities provided are as follows: ALTER, BYTES, COPY, DELETE, FIND, HELP, INSERT, KEEP, MOVE, RENUMBER, AND VERIFY. The Spectrum Toolkit contains most of the features above plus autoline numberer and append, and will run in the 16K and 48K Spectrum.



4K GRAPHICS ROM £24.95

This module unlike most other accessories fits neatly inside your computer under the keyboard. The module come ready built fully tested and complete with a 4K graphic ROM.This will give you an unbelieveable number of extra pre-programmed graphics. This now turns the 81 into a very powerful computer with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders, graphics and that only accounts for about 50 of them, there are still approximately 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there, it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder can be fitted with a 1K/2K/RAM and can be used for user definable graphics so you can create your own custom character sets.

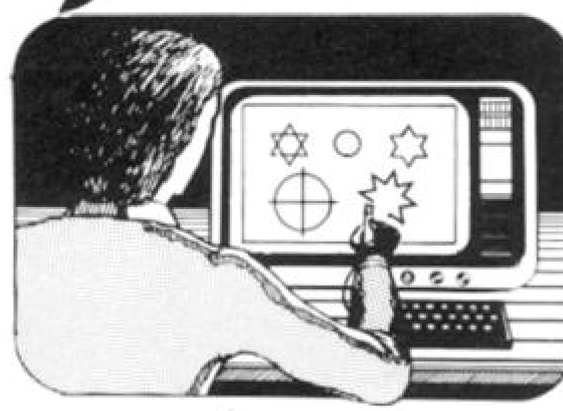
SPECTRA-SOUND

The so called speaker in your Spectrum is really only a 'buzzer'. With the DK Tronics "SPECTRA SOUND" you can generate fully amplified sound through the speaker on your T.V. set. SPECTRA-SOUND is a very simple but highly effective add-on. This means that you no longer have a faint beep but a highly amplified sound, which can be adjusted with the TV volume control.

The SPECTRA SOUND fits compactly and neatly inside the Spectrum case and is connected by three small crocodile clips. **NEW AT ONLY £9.95**

£19.95 Light Pen

LIGHT PEN



The pen enables you to produce high resolution drawings on your own T.V. screen. The controlling software supplied with the light pen has 16 pre-defined instructions. These are chosen from a menu positioned at the bottom of the screen next to the pen.

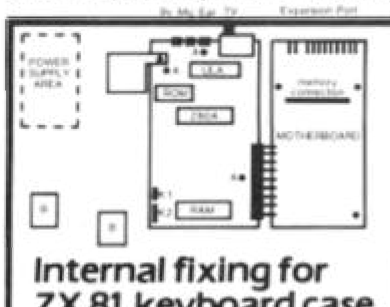
You can utilise the menu for changing colour (Border, Paper, Ink). Drawing circles, arcs, boxes, lines. You are also able to fill any object with any colour, and insert text onto the screen at any chosen place. Of course you can also draw freehand. There is a feature to retain the screens and animate. On the 48K Spectrum you can retain 5 screens.

You can also use the machine code on it's own in your own programs, for selecting out of a menu etc. The software provided will return with the X,Y, cords for it's position on the screen.

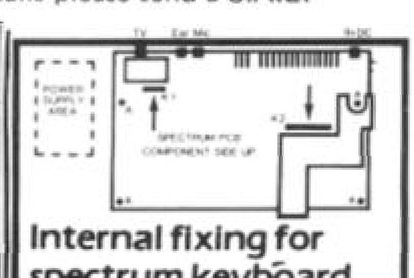
The light pen is supplied with a control interface in order to adjust the sensitivity/pen alignment.

This simply plugs into the ear socket on your spectrum.

Should you require further details please send a S.A.E.



Internal fixing for ZX 81 keyboard case.



Internal fixing for spectrum keyboard case.

Please state type of machine, which ROM memory size, quantity, and place when ordering.

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Competition

Have some fun, and maybe win yourself a joystick package for your Spectrum or ZX81!

Okay, settle down now and don your competition hats. This issue we've got some great prizes for you to win, and all you have to do is to put some lines to go with the cartoon below.

You'll all have seen competitions like this before I'm sure and I'm afraid it's one of those awkward times where there is no real answer for you to find. You just have to stir up the grey matter and come up with a line or two which complements the cartoon and hopefully makes us laugh here at the ZX Computing editorial offices.

Once again, you'll have to cope with our strange sense of humour but if the limericks which are streaming into the office from last issue's competition are anything to go by, you should have no problem at all! Again, we would like to publish the best three captions, so try and keep them clean; still, if you feel otherwise inclined, we always need a laugh.

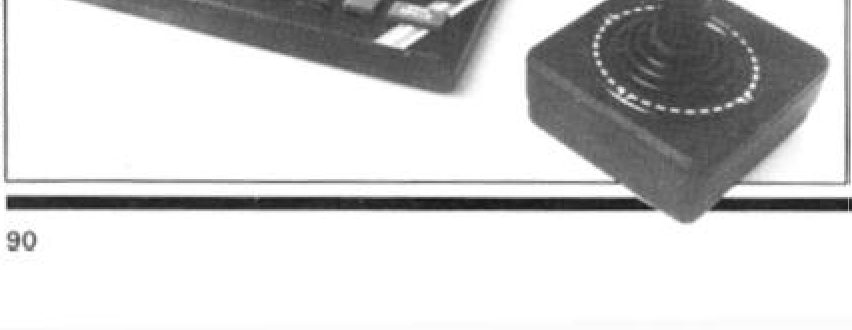


The prizes

There will be three winners to the competition, those with captions which show originality and most of all, humour.

Each of the three prize winners will receive a joystick package courtesy of AGF Hardware. Each package will consist of two Atari joystick controllers, one Interface module II (Spectrum or ZX81 version) and a 'Video Graffiti' demonstration program.

You should have no trouble finding compatible software for the joysticks should you win. The interface is compatible with 28 games from 14 companies for the Spectrum and there are 20 games compatible with the ZX81 from 11 companies. You can also, following the instructions accompanying the joystick package, incorporate the joystick facility in your own programs.



The AGF joystick package for the Spectrum.

Rules

- This competition is open to all UK and Northern Ireland readers of *ZX Computing* except employees of Argus Specialist Publications Ltd, their printers and distributors, employees of AGF Hardware, or anyone else associated with the competition.
- As long as the correct coupon is used for each entry, there is no limit to the number of entries from each individual.
- All entries must be postmarked before September 31st, 1983. The prizes will be awarded to the best three entries, the decision to be made by the Editor of *ZX Computing*. No correspondance will be entered into with regard to the results and it is a condition of entry that the Editor's decision is accepted as final.
- The winners will be notified by post and the results will be published in a future issue of *ZX Computing*.

Address your entires to:

ZX Computing — cartoon caption,
145 Charing Cross Road,
London WC2H 0EE.

Results

Congratulations to Dennis Plowman of Dunkirk, Nottingham, for you sent us the entry that was first to be picked out of the competition bag in our April/May competition. The prize of 12 books about the ZX Spectrum is, as you are reading this, on its way to you courtesy of the Post Office.

In case any of you are keen

to find out whether you got the answers right and want to get some programming in at the same time, then you might be interested in an ingenious entry from Peter Cameron of Oxford. Instead of engaging brain and settling down to a couple of hours of word searching, he switched on his Spectrum and got to work.

The program he wrote is not terribly fast — running speed about six minutes with the data provided in the competition — but he assures me it is an improvement by a factor of four on his first program which stood at all points in the array and looked in all directions. The present version of his program stands on the edge of the array and looks across, and then uses string slicing.

Here follows Peter's program along with the output he needed to solve the competition. Well done Peter, you may not have won the prize but I'm sure we can find something to brighten up your bookshelves as a consolation prize!

```
  10 PRINT AT 10,10;"WORDSQUARES"
  20 INPUT "Number of rows? ";rows: INPUT "Number of columns? ";cols
  30 DIM a$(rows,cols): LET f=0: IF rows<=22 AND cols<=32 THEN LET f=1: CLS
  40 FOR i=1 TO rows: INPUT "Enter next row ";a$(i): PRINT a$(i) AND f: NEXT i
  50 INPUT "Number of words? ";no: INPUT "Longest word? ";long
  60 DIM b$(no,long): DIM c(no)
  70 FOR i=1 TO no: INPUT "Enter next word ";x$: LET b$(i)=x$: LET c(i)=LEN x$: NEXT i
  80 CLS
 100 FOR s=0 TO 8
 110 IF s=4 THEN GO TO 200
 120 LET dr=INT (s/3)-1: LET dc=s-3*INT (s/3)-1
 130 IF s=5 THEN LET c=1: FOR r=1 TO rows: LET v$=a$(r): GO SUB 400: NEXT r: GO TO 200
 140 IF dr=0 THEN GO TO 180
 150 LET r=(dr=1)+(rows AND dr=-1)
 160 FOR c=1 TO cols: GO SUB 300: GO SUB 400: NEXT c
 170 IF dc=0 THEN GO TO 200
 180 LET c=(dc=1)+(cols AND dc=-1)
 190 FOR r=1+ABS dr TO rows-ABS dr: GO SUB 300: GO SUB 400: NEXT r
 200 NEXT s
 210 PRINT "Search complete": STOP
 300 LET rx=r: LET cx=c: LET v$=a$(r,c)
 310 LET rx=rx+dr: LET cx=cx+dc
 320 IF rx<1 OR rx>rows OR cx<1 OR cx>cols THEN RETURN
 330 LET v$=v$+a$(rx,cx): GO TO 310
 400 LET l=LEN v$
 410 FOR j=1 TO no
 420 IF l<c(j) THEN GO TO 470
 430 FOR k=1 TO l-c(j)+1
 440 IF v$(k TO k+c(j)-1)<>b$(j, TO c(j)) THEN GO TO 460
 450 PRINT b$(j, TO c(j));" located,"'"start row ";r+(k-1)*dr;", column ";c+(k-1)*dc;","'"direction ";("north" AND dr=-1)+("south" AND dr=1)+("west" AND dc=-1)+("east" AND dc=1);"."''
 460 NEXT k
 470 NEXT j
 480 RETURN
```

Peter Cameron's Wordsquare program.

```
WILLIAMTANG located,
start row 15,column 13,
direction northwest.

DILWYNJONES located,
start row 16,column 3,
direction north.

BRIANLOGAN located,
start row 1,column 13,
direction west.

TIMLANGDELL located,
start row 4,column 13,
direction west.

TIMHARTNELL located,
start row 14,column 13,
direction west.

DAVIDHARWOOD located,
start row 16,column 14,
direction west.

TREVORTOMS located,
start row 2,column 5,
direction east.

MIKELORD located,
start row 7,column 6,
direction east.

MARTINWRENHILTON located,
start row 2,column 2,
direction south.

SMGEE located,
start row 11,column 5,
direction south.

ROBINBRADBEER located,
start row 1,column 12,
direction south.

Search complete
```

The output from Peter Cameron's program.

Competition

Name . . . .

Address . . . .

. . . .

. . . . Postcode . . . .

My caption for the cartoon is:

. . . .

. . . .

. . . .

. . . .

(please write your caption in block capitals)

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Equation solver

$Y=F(X)=X^3+3X^2-10X-5$

John Norbury shows us how to solve equations on the ZX81 using the bisection method.

Suppose that you want to solve an equation of the form f(x) = 0, such as:

$$y = f(x) = x^3 + 3x^2 - 10x - 5$$

The roots of this equation are the values of x for which y = 0. You can find roughly where they occur from a sketch graph (Fig. 1) which shows that the curve cuts the x axis at three places. One is between x = −5 and x = −4, another between x = −1 and x = 0, and the third is between x = 2 and X = 3.

You could find this same information by tabulating the values of y = f(x) for a range of values between, say, −10 and +10 (Fig. 2). Where the sign of y changes from plus to minus, or *vice versa*, is the interval in which you could expect to find a root. The table shows that there are again the three intervals (−5, −4), (−1, 0) and 2,3) which need to be studied in more detail.

The bisection method takes each interval in turn, divides it into two equal parts, and decides in which half the root is to be found. It then divides that half into two equal parts and repeats the process. This iteration continues until the size of the portion so formed is smaller than the specified error, at which point it gives the mid-point of the portion as the root of the equation. It is here that the graph crosses the x axis and changes sign.

Advantages and disadvantages

Unless you tabulate the function over a very wide range, you cannot be sure of finding all the roots of an equation. Nor can you find any roots that might be complex numbers, such as the solution to the equation $y = x^2 + 1$, for its graph does not even cross the x axis (Fig. 3). However, you can find the solutions to whatever accuracy you like given sufficient iterations and, as the method does not suffer from instability, it always converges to the required answer.

Between the lines

The program will run with about 4½K RAM. The following describes the structure of the program.

Lines 10-110 set up the default values of the parameters. The equation to be solved is held as A$.

Lines 200-360 print the menu and choose the selected subroutine.

Lines 1000-1030 allow the equation to be entered or changed. To prevent program execution stopping with the report code A, powers of x such as x^3 should be entered as x ✱ x ✱ x, and so on.

Lines 2000-2080 specify the interval in which you are searching for a root.

Lines 3000-3040 ask for the number of values that you want to tabulate.

Lines 4000-4090 tabulate the function over the range set by option 2. If a change of sign occurs between the lowest and highest points of the range, the bisection method can be used. If two or more changes of sign occur, the interval set by option 2 should be reduced to include just one such sign change. If no change of sign occurs, then a wider interval could be tried.

Lines 5000-5040 allow the maximum permitted error in the answer to be set. The smaller this is made, the longer it will take and the more iterations will be needed to reach the solution. In fact, the error depends on $1/2^n$, where n is the number of iterations.

Lines 6000-6230 carry out the actual bisection process, letting the user know if an incorrect interval has been set by option 2.

Lines 7000-7050 list the current values of all the parameters,

Fig. 2.

```
TABLE OF VALUES BETWEEN -10 AND
10 OF X*X*X+3*X*X-10*X-5

X=-10                F(X)=-605
X=-9                 F(X)=-401
X=-8                 F(X)=-245
X=-7                 F(X)=-131
X=-6                 F(X)=-53
X=-5                 F(X)=-5
X=-4                 F(X)=19
X=-3                 F(X)=25
X=-2                 F(X)=19
X=-1                 F(X)=7
X=0                  F(X)=-5
X=1                  F(X)=-11
X=2                  F(X)=-5
X=3                  F(X)=19
X=4                  F(X)=67
X=5                  F(X)=145
X=6                  F(X)=259
X=7                  F(X)=415
X=8                  F(X)=619
X=9                  F(X)=877
X=10                 F(X)=1195
```

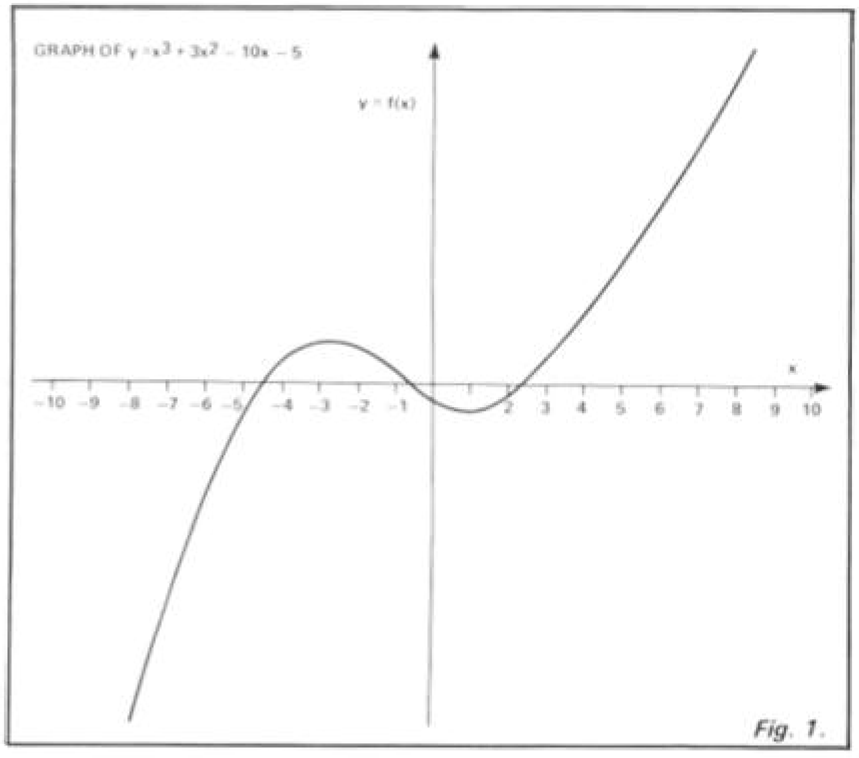


Fig. 1.

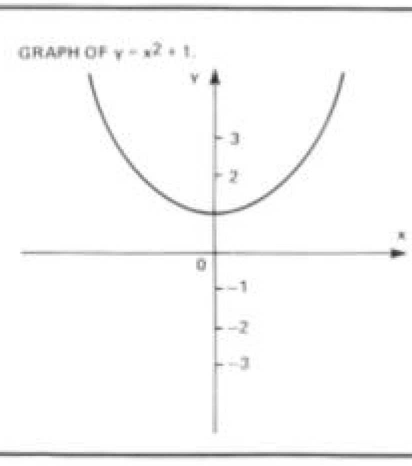


Fig. 3.

including the equation itself. Lines 9000-9070 wait for the user to specify either a return to the menu or a printout of screen contents. The program will run as it is even if no printer is available.

How to use the program

When first run, choose option 1 and enter the test equation $x^3 + 3x^2 - 10x - 5$ in the form:

x ✱ x ✱ x + 3 ✱ x ✱ x − 10 ✱ x − 5

Then choose option 2 and specify the interval from −10 to +10. Option 3 should be used to ask for 20 tabulation points. Option 4 will list the values of the equation at these 20 points, and will also tell you what to do when the screen fills up. The table should look like that in Fig. 1. Three changes of sign are found, so we call up option 2 again and enter the interval (−5, −4).

Next, we choose an error of less than 0.00001 using option 5. Option 6 calculates the root in our chosen interval as −4.84946. You can then return to option 2 to set the other two intervals in which there is a root of the equation.

Note that the test equation is a cubic, for which there can only be three roots. However, any polynomial or trigonometric equation can be entered, for example, sin(x) + tan(x) − $3x^2$ + 4x.

With practice, this becomes an effective and reliable way of solving all sorts of equations — especially recommended for maths homework!

```
   1 SLOW
  10 REM BISECTION METHOD FOR RO
OTS OF EQUATION Y=F(X)
  20 REM (A,B) IS INTERVAL IN WH
ICH A ROOT IS SOUGHT
  30 LET A=-1
  40 LET B=1
  50 REM A$ IS EQUATION FOR F(X)
  60 LET A$="X"
  70 REM E IS MAXIMUM ERROR ALLO
WED FOR ROOT
  80 LET E=0.001
  90 REM N IS NUMBER OF TABULATI
ON POINTS IN INTERVAL (A,B)
 100 LET N=10
 110 LET X=0
 200 PRINT AT 0,10;"OPTIONS"
 210 PRINT AT 2,0;"1  INPUT THE
EXPRESSION FOR F(X)"
 220 PRINT AT 4,0;"2  INPUT INTE
RVAL (A,B) IN WHICH   ROOT IS BE
ING SOUGHT"
 230 PRINT AT 7,0;"3  INPUT NUMB
ER OF TABULATION      POINTS"
 240 PRINT AT 10,0;"4  TABULATE
EXPRESSION DEFINED     BY OPTION
 1 BETWEEN A AND B"
 250 PRINT AT 13,0;"5  INPUT REQ
UIRED ACCURACY"
 260 PRINT AT 15,0;"6  FIND ROOT
 IN (A,B) BY METHOD    OF BISECT
ION"
 270 PRINT AT 18,0;"7  LIST CURR
ENT PARAMETERS"
 280 PRINT AT 20,0;"8  STOP"
 300 LET Z$=INKEY$
 310 IF Z$="" OR CODE Z$<29 OR C
ODE Z$>36 THEN GOTO 300
 320 LET Z=VAL Z$
 330 CLS
 340 GOSUB 1000*Z
 350 CLS
 360 GOTO 200
1000 PRINT AT 5,0;"ENTER EXPRESS
ION F(X) IN           CORRECT SYNTA
CTIC FORM"
1010 INPUT A$
1020 PRINT AT 8,0;"F(X)=";A$
1030 GOTO 9000
2000 PRINT AT 5,0;"ENTER LOWEST
AND HIGHEST POINTS OF RANGE FOR
TABULATION"
2010 PRINT AT 8,0;"LOWEST FIRST:
 A=?"
2020 INPUT A
2030 PRINT AT 8,16;A
2040 PRINT AT 10,0;"NOW THE HIGH
EST: B=?"
2050 INPUT B
2060 IF B<=A THEN GOTO 2050
2070 PRINT AT 10,19;B
2080 GOTO 9000
3000 PRINT AT 5,0;"ENTER NUMBER
OF TABULATION          POINTS"
3010 INPUT N
3020 IF N<>INT N OR N<1 THEN GOT
O 3010
3030 PRINT AT 8,0;"N=";N
3040 GOTO 9000
4000 FOR X=A TO B STEP (B-A)/N
4010 PRINT "X=";X;TAB 15;"F(X)="
;VAL A$
4020 IF PEEK 16442>4 THEN GOTO 4
080
4030 PRINT "PRESS C TO CONTINUE"
4040 LET Z$=INKEY$
4050 IF Z$="" THEN GOTO 4040
4060 IF Z$<>"C" THEN GOTO 8990
4070 CLS
4080 NEXT X
4090 GOTO 9000
5000 PRINT AT 5,0;"ENTER MAXIMUM
 ALLOWED ERROR"
5010 INPUT E
5020 IF E<=0 THEN GOTO 5010
5030 PRINT AT 8,0;"E=";E
5040 GOTO 9000
6000 LET A1=A
6010 LET B1=B
6020 LET X=A
6030 LET VA=VAL A$
6040 LET X=B
6050 LET VB=VAL A$
6060 IF VA*VB<0 THEN GOTO 6090
6070 PRINT AT 5,0;"NO ROOT IN IN
TERVAL (";A;",";B;")";AT 8,0;"F(
X) MUST HAVE DIFFERENT SIGN AT A
AND B"
6080 GOTO 9000
6090 PRINT AT 2,10;"PLEASE WAIT"
6100 LET X=(A1+B1)/2
6110 LET ME=(B1-A1)/2
6120 IF ME<E THEN GOTO 6210
6130 LET VX=VAL A$
6140 LET STORE=X
6150 LET X=A1
6160 LET VA=VAL A$
6170 LET X=STORE
6180 IF VA*VX<=0 THEN LET B1=X
6190 IF VA*VX>0 THEN LET A1=X
6200 GOTO 6100
6210 PRINT AT 5,0;"VALUE OF ROOT
 IS ";X
6220 PRINT AT 7,0;"MAXIMUM ERROR
 IS ";E
6230 GOTO 9000
7000 PRINT AT 5,0;"EXPRESSION IS
"
7010 PRINT AT 6,2;"F(X)=";A$
7020 PRINT AT 8,0;"INTERVAL IS (
";A;",";B;")"
7030 PRINT AT 10,0;"NUMBER OF TA
BULATION POINTS        IS ";N
7040 PRINT AT 13,0;"MAXIMUM ERRO
R FOR SOLUTIONS        IS ";E
7050 GOTO 9000
8000 STOP
8990 IF INKEY$<>"" THEN GOTO 899
0
9000 PRINT AT 20,0;"PRESS C FOR
COPY, ANY OTHER KEY TO RETURN TO
 OPTION POINT"
9010 LET Y$=INKEY$
9020 IF Y$="" THEN GOTO 9010
9030 IF Y$<>"C" THEN RETURN
9040 REM 65 SPACES IN NEXT LINE
9050 PRINT AT 20,0;"
                    "
9060 COPY
9070 GOTO 9000
```

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Moon rescue

Rescue the astronauts in this lunar listing for your Spectrum, courtesy of John Miller.

The object of this game is to rescue the ten astronauts stranded on the moon. You have three rather ancient space craft capable only of left and right movement, and an initial thrust to clear the surface of the moon.

At the beginning of the game, you are docked in your mothership traversing left and right at the top of the screen. Below are asteroid-type objects, and all you have to do is to get through this layer and you'll find the astronauts on the surface of the moon.

Moon madness

To start your descent, press the '0'; after that you can only move left and right using the '5' and '8' keys respectively — you descend automatically. During your descent you must avoid hitting the asteroids and then attempt to land your craft on the magenta landing pads. Once down safely, there will be a short delay while one of the astronauts clambers aboard. You then have to make your way back to the mothership, this time trying to avoid the cyan enemy ships which guard the planet.

To begin your ascent, press the '0' key again and then guide your ship using the cursor keys to move left and right until you dock with the mothership. Once docked, you unload your human cargo and head off to rescue another astronaut.

The game ends when you have either rescued all ten astronauts or lost all three of your ships. Should you find the game too easy, you could always alter the velocities of the asteroids and the enemy space craft by changing the value of PINC in line 9042.

```
   2 RESTORE 9900: GO SUB 9100
   5 RESTORE : GO SUB 9000
   7 GO SUB wait
  10 GO TO stage1
  20 GO TO stage2
  30 IF ship<4 AND man<10 THEN G
O TO 10
  40 GO TO endgame
1000 REM stage1
1001 LET up=0
1002 LET x=2: LET y=3: LET mothx
=0: DIM a$(5,32): DIM i$(5,32)
1005 LET man=man+1
1007 LET pointer=1
1008 LET inc=1
1010 FOR c=1 TO 5: FOR d=1 TO 32
1020 IF RND*(11-man)<.4 THEN LET
 a$(c,d)="G"
1030 NEXT d: NEXT c
1035 CLS
1040 GO SUB surface
1050 GO SUB topprint
1060 PRINT AT 0,6; INK 6;score;A
T 0,17; INK 5;high;AT 0,30; INK
7;ship
1070 FOR c=1 TO 5: PRINT AT 4+c*
2,0; INK 6;a$(c): NEXT c
1080 PRINT AT 2,0;m$;AT 3,0;n$;A
T y,x
1085 PRINT AT 3,3;s$
1200 LET mothx=mothx+inc: IF NOT
 drop THEN LET x=x+inc
1201 IF mothx=26 THEN LET inc=-1
1202 IF mothx=1 THEN LET inc=1
1205 PRINT AT 2,mothx;m$;AT 3,mo
thx;n$: PRINT AT y,x;s$
1210 LET pointer=pointer+pinc: I
F pointer>32 THEN LET pointer=1
1215 FOR c=1 TO 5: PRINT INK 6;A
T 4+c*2,0;a$(c,pointer TO );a$(c
, TO pointer-1): NEXT c
1220 IF INKEY$="0" THEN LET drop
=1
1221 BEEP .005,24*drop-12: BEEP
.005,24*drop-10
1223 PRINT AT y,x;"  "
1225 LET y=y+drop: IF y=21 THEN
GO TO shiploss
1227 IF NOT drop THEN GO TO 1200
1230 LET x=x-(INKEY$="5" AND x>0
)+(INKEY$="8" AND x<32)
1235 IF ATTR (y,x)=3 THEN GO TO
20
1240 IF SCREEN$ (y,x)="" THEN GO
 TO shiploss
1300 GO TO 1200
1999 STOP
2000 PRINT AT y-1,x;s$: FOR c=1
TO 10: BEEP .1,-10+c: BEEP .1,-1
0-c: NEXT c
2001 LET up=0: LET drop=0
2002 LET pointer=1
2005 LET"m(nman)=0: LET nman=nma
n+1
2010 CLS : GO SUB surface: GO SU
B topprint
2020 LET y=y-1: PRINT AT y,x;s$
2030 FOR c=1 TO 5: FOR d=1 TO 32
2040 IF RND*(11-man)<.4 THEN LET
 i$(c,d)="H"
2050 BEEP .005,30: NEXT d: NEXT
c
```

```
2055 LET score=score+250
2060 PRINT AT 0,5; INK 6;score;A
T 0,17; INK 5;high;AT 0,30; INK
7;ship
2070 FOR c=1 TO 5: PRINT AT 4+c*
2,0; INK 5;i$(c): NEXT c
2080 PRINT AT 2,mothx;m$;AT 3,mo
thx;n$
2100 LET mothx=mothx+inc
2101 IF mothx=28 THEN LET inc=-1
2102 IF mothx=1 THEN LET inc=1
2105 PRINT AT 2,mothx;m$;AT 3,mo
thx;n$
2106 PRINT AT y,x;s$
2110 LET pointer=pointer+pinc: I
F pointer>32 THEN LET pointer=1
2115 FOR c=1 TO 5: PRINT INK 5;A
T 4+c*2,0;i$(c,pointer TO );i$(c
, TO pointer-1): NEXT c
2120 IF INKEY$="0" THEN LET up=1
2130 BEEP .005,24*up-12: BEEP .0
25,24*up-10
2140 PRINT AT y,x;" "
2150 LET y=y-up: IF y<3 THEN GO
TO shiploss
2160 IF y=3 AND x=mothx+2 THEN G
O TO home
2170 IF NOT up THEN GO TO 2100
2180 LET x=x-(INKEY$="5" AND x>0
)+(INKEY$="8" AND x<32)
2190 IF SCREEN$ (y,x)="" THEN GO
 TO shiploss
2200 GO TO 2100
2999 STOP
3000 INK 7: PAPER 0: BORDER 0: C
LS
3010 FOR c=0 TO 50: PLOT RND*255
,RND*175: NEXT c
3020 PRINT AT 5,4; INK 5;"WELCOM
E TO 'MOON RESCUE'"
3030 PRINT AT 16,0; FLASH 1; BRI
GHT 1;"PRESS ANY KEY WHEN YOU AR
E READY"
3040 IF INKEY$="" THEN GO TO 304
0
3045 PRINT AT 16,0; OVER 1;"PRES
S ANY KEY WHEN YOU ARE READY"
3050 RETURN
4000 INK 4: PRINT AT 17,0;"I
                          M"
4001 PRINT AT 18,0;"I
                        M"
4002 PRINT AT 19,0;"I
                      M"
4003 PRINT AT 20,0;"I          "; IN
K 3;"KN"; INK 4;"          "; IN
K 3;"KN"; INK 4;"          M"
4004 PRINT AT 21,0;"JJJJJJ
JJJJJJJJJJJJJJ"
4005 FOR c=1 TO 10: IF m(c)>0 TH
EN PRINT AT 20,m(c); INK 6;"L"
4006 NEXT c
4010 INK 7: RETURN
5000 PRINT AT 0,0; INK 6; BRIGHT
 1;"SCORE:          "; INK 5;"HIGH:
       "; INK 7;"SHIP:   "
5010 PRINT INK 3;"
"
5020 RETURN
5500 FOR c=0 TO 7 STEP .5: PRINT
 AT y,x; INK c;"E": BEEP .01,c*5
: BEEP .01,c*-5: NEXT c
5510 LET score=score+300: GO TO
30
6000 FOR c=y TO 20: PRINT AT c,x
: INK RND*7;"E"; OVER 1;AT c,x;"
E": BEEP .01,-c: NEXT c
6005 BEEP 1,-20: PAUSE 50
6010 LET ship=ship+1: LET drop=0
: LET up=0: CLS : GO TO 30
8000 PRINT AT 6,11; FLASH 1;"GAM
E OVER"
8010 IF score>high THEN LET high
=score: FOR c=1 TO 10: BEEP .01,
RND*50: BORDER RND*7: NEXT c: BO
RDER 0: PRINT AT 11,0; BRIGHT 1;
 FLASH 1;"WELL DONE - A NEW HIGH
 SCORE!!!!"
8020 PAUSE 250: CLS : GO TO 5
8999 STOP
9000 DIM a$(5,32): DIM i$(5,32)
9010 LET ship=1: LET man=0: LET
x=2: LET y=3: LET nman=1
9015 LET s$=CHR$ 19+CHR$ 1+"E":
LET m$=" "+CHR$ 16+CHR$ 2+"ABC "
: LET n$=" "+CHR$ 15+CHR$ 2+"D F
 "
9020 LET mothx=0: LET drop=0: LE
T score=0
9030 LET stage1=1000: LET stage2
=2000: LET endgame=8000
9040 LET wait=3000
9042 LET pinc=2
9045 LET surface=4000
9047 LET topprint=5000: LET ship
loss=6000
9048 LET home=5500
9050 DIM m(10): FOR c=1 TO 10
9060 READ m(c): NEXT c
9070 DATA 4,5,6,11,14,15,17,23,2
5,26
9080 RETURN
9100 FOR c=USR "a" TO USR "n"+7:
 READ a: POKE c,a: NEXT c
9101 LET high=0
9099 RETURN
9900 DATA BIN 0,BIN 100,BIN 0011
1111,BIN 1111111,BIN 1100000,BIN
 11110110,BIN 11111111,BIN 11111
111
9901 DATA BIN 11000,BIN 1111110,
BIN 11111111,BIN 11111111,BIN 0,
BIN 11111111,BIN 11100111,BIN 11
000011
9902 DATA BIN 0,BIN 100000,BIN 1
1111100,BIN 11111110,BIN 111,BIN
 1101111,BIN 11111111,BIN 111111
11
9903 DATA BIN 11111000,BIN 11111
000,BIN 11111000,BIN 1111100,BIN
 111111,BIN 11111,BIN 1111,BIN 1
11
9904 DATA BIN 1000,BIN 11100,BIN
 1111111,BIN 1001001,BIN 1011101
,BIN 111110,BIN 100010,BIN 10000
01
9905 DATA BIN 11111,BIN 11111,BI
N 11111,BIN 111110,BIN 11111100,
BIN 11111000,BIN 11110000,BIN 11
100000
9906 DATA BIN 11000,BIN 1111100,
BIN 1111110,BIN 1111111,BIN 111
1111,BIN 1111110,BIN 111000,BIN
10000
9907 DATA BIN 0,BIN 111100,BIN 1
100110,BIN 11111111,BIN 11111111
,BIN 10111101,BIN 1000010,BIN 10
0100
9908 DATA BIN 10000000,BIN 11000
000,BIN 11100000,BIN 11110000,BI
N 11111000,BIN 11111000,BIN 1111
1110,BIN 11111111
9909 DATA BIN 1,BIN 10110011,BIN
 11111111,255,255,255,255,255
9910 DATA BIN 1111111,BIN 111111
,BIN 11111,BIN 1111,BIN 111,BIN
111,BIN 1,BIN 0
9911 DATA BIN 0,BIN 11100,BIN 11
100,BIN 1001001,BIN 111110,BIN 1
000,BIN 10100,BIN 100010
9912 DATA BIN 1,BIN 11,BIN 11,BI
N 1111,BIN 11111,BIN 111111,BIN
1111111,BIN 11111111
9913 DATA BIN 11111110,BIN 11111
100,BIN 1111100,BIN 11110000,BI
N 11100000,BIN 11000000,BIN 1000
0000,0
9999 RETURN
```

The profit prophet

A serious program to help you get to grips with your business written for us by Michael Carroll of Wexford, Ireland.

The object of this program is to help a company or financial institution measure their profitability.

On RUNning the program you will be greeted with a menu which will provide a route through to the particular ratio you require. Here follows a list of the facilities available with this program:

a) Return on investment.
b) Net profit percentage.
c) Asset turnover.
d) Gross profit percentage.
e) Selling expenses/sales.
f) Administration expenses/sales.
g) Establishment expenses/sales.
h) Financial expenses/sales.
i) Sales and distribution expenses/sales.
j) Research and development expenses/sales.
k) Fixed asset turnover.
l) Current asset turnover.
m) Working capital turnover.
n) Debtor's turnover.
o) Rate of stock turnover.
p) Current asset ratio.
q) Acid test.
r) Average period of credit given.
s) Average period of credit received.
t) Earnings per share.
u) P. E. ratio.
v) Dividend per share.
w) Dividend yield.
x) Dividend cover.
y) Capital employed.

As you can see from the long list of options, the program certainly tries to fill in the gaps of your business knowledge.

In fact, the author has added a number of program notes which will be revealed should you choose certain options. These are not part of the operation of the program but illustrate certain patterns which developed over a period of trading months so were added for the author's convenience. Should these not apply to you they could be left out or have new comments substituted.

```
  10 GOSUB 9000
  32 PAUSE 90
  34 CLS
  40 PRINT "ZX81 PROFITABILITY M
EASURES"
  45 PRINT "--------------------
------------"
  50 PRINT "A) RETURN ON INVESTM
ENT"
  51 PRINT
  55 PRINT "B) NET PROFIT PERCEN
TAGE"
  56 PRINT
  60 PRINT "C) ASSET TURNOVER"
  61 PRINT
  65 PRINT "D) GROSS PROFIT PERC
ENTAGE"
  66 PRINT
  70 PRINT "E) SELLING EXPENSES/
SALES"
  71 PRINT
  75 PRINT "F) ADMINISTRATION EX
PENSES/SALES"
  76 PRINT
  80 PRINT "G) ESTABLISHMENT EXP
ENSES/SALES"
  81 PRINT
  85 PRINT "H) FINANCIAL EXPENSE
S/SALES"
  86 PRINT
  90 PRINT "I) SALES+DISTRIB.EXP
./SALES"
  91 PRINT
 100 PRINT "ENTER OPTION LETTER
OR JUST N/L"
 110 INPUT J$
 120 IF J$="" THEN GOTO 130
 125 GOTO (CODE J$*100)
 130 CLS
 135 PRINT "ZX81 PROFITABILITY R
ATIOS"
 140 PRINT "--------------------
------------"
 150 PRINT "J) RES.+DEVELOPMENT
EXP./SALES"
 151 PRINT
 155 PRINT "K) FIXED ASSET TURNO
VER"
 156 PRINT
 160 PRINT "L) CURRENT ASSET TUR
NOVER"
 161 PRINT
 165 PRINT "M) WORKING CAPITAL T
URNOVER"
 166 PRINT
 170 PRINT "N) DEBTORS TURNOVER"
 171 PRINT
 175 PRINT "O) RATE OF STOCK TUR
NOVER"
 176 PRINT
 180 PRINT "P) CURRENT ASSET RAT
IO"
 181 PRINT
 185 PRINT "Q) ACID TEST"
 186 PRINT
 190 PRINT "R) AV.PERIOD OF CRED
IT GIVEN"
 196 PRINT
 200 PRINT "ENTER OPTION LETTER
OR JUST N/L"
 210 INPUT J$
 220 IF J$="" THEN GOTO 230
 225 GOTO (CODE J$*100)
 230 CLS
 235 PRINT "ZX81 PROFITABILITY R
ATIOS"
 240 PRINT "--------------------
------------"
 245 PRINT "S) AV.PERIOD OF CRED
IT REC""D"
 247 PRINT
 250 PRINT "T) EARNINGS PER SHAR
E"
 251 PRINT
 255 PRINT "U) P.E.RATIO"
 256 PRINT
 260 PRINT "V) DIVIDEND PER SHAR
E"
 261 PRINT
 265 PRINT "W) DIVIDEND YIELD"
 266 PRINT
 270 PRINT "X) DIVIDEND COVER"
 271 PRINT
 275 PRINT "Y) CAPITAL EMPLOYED"
 276 PRINT
 280 PRINT "Z) END"
 281 PRINT AT 20,0;
 300 PRINT "ENTER OPTION LETTER
OR JUST N/L"
 310 INPUT J$
 320 IF J$="Z" THEN STOP
 330 GOTO (CODE J$*100)
 340 STOP
3800 CLS
3802 PRINT "RETURN ON INVESTMENT
"
3804 PRINT ,,"NET PROFIT=?";
3806 INPUT N$
3808 PRINT N$
3810 PRINT "CAPITAL EMPLOYED=";
3812 INPUT C$
3814 PRINT C$
3816 IF N$="?" OR C$="?" THEN RU
N
3818 PRINT "RETURN ON INVESTMENT
=";INT ((VAL N$/VAL C$)*100);" %
"
```

```
3820 PRINT
3830 GOTO 7000
3900 CLS
3902 PRINT "NET PROFIT PERCENTAG
E:"
3904 PRINT ,,"NET PROFIT=";
3906 INPUT N$
3908 PRINT N$
3910 PRINT "SALES=";
3912 INPUT S$
3914 PRINT S$
3916 IF N$="?" OR S$="?" THEN RU
N
3918 PRINT "NET PROFIT PERCENTAG
E=";INT ((VAL N$/VAL S$)*100);"
■"
3920 PRINT
3930 PRINT "PRESS N/L TO CONTINU
E"
3932 PAUSE 4E4
3934 GOTO 6600
4000 CLS
4002 PRINT "ASSET TURNOVER:"
4004 PRINT ,,"SALES=";
4006 INPUT S$
4008 PRINT S$
4010 PRINT "CAPITAL
     EMPLOYED=";
4012 INPUT C$
4014 PRINT C$
4016 IF S$="?" OR C$="?" THEN RU
N
4018 PRINT "ASSET TURNOVER=";INT
 ((VAL S$/VAL C$))
4020 PRINT
4030 GOTO 7000
4100 CLS
4102 PRINT "GROSS PROFIT PERCENT
AGE:"
4104 PRINT ,,"GROSS PROFIT=";
4106 INPUT G$
4108 PRINT G$
4110 PRINT "SALES=";
4112 INPUT S$
4114 PRINT S$
4116 IF G$="?" OR S$="?" THEN RU
N
4118 PRINT "GROSS PROFIT PERCENT
AGE=";INT ((VAL G$/VAL S$)*100);
"■"
4120 PRINT ,,"PRESS N/L TO CONTI
NUE"
4122 PAUSE 4E4
4124 GOTO 6600
4200 CLS
4202 PRINT "SALES EXPENSES/SALES
:"
4204 PRINT ,,"SALES EXPENSES=";
4206 INPUT E$
4208 PRINT E$
4210 PRINT "SALES=";
4212 INPUT S$
4214 PRINT S$
4216 IF E$="?" OR S$="?" THEN RU
N
4218 PRINT "SALES EXPENSES/SALES
=";INT ((VAL E$/VAL S$)*100);"■
"
4220 PRINT
4222 GOTO 7000
4300 CLS
4302 PRINT "ADM.EXPENSES/SALES:"
4304 PRINT ,,"ADM.EXPENSES=";
4306 INPUT E$
4308 PRINT E$
4310 PRINT "SALES=";
4312 INPUT S$
4314 PRINT S$
4316 IF S$="?" OR E$="?" THEN RU
N
4318 PRINT "ADM.EXPENSES/SALES="
;INT ((VAL E$/VAL S$)*100);"■"
4320 PRINT
4322 GOTO 7000
4400 CLS
4402 PRINT "EST.EXPENSES/SALES:"
4404 PRINT ,,"EST.EXPENSES=";
4406 INPUT E$
4408 PRINT E$
4410 PRINT "SALES=";
4412 INPUT S$
4414 PRINT S$
4416 IF S$="?" OR E$="?" THEN RU
N
4418 PRINT "EST.EXPENSES/SALES="
;INT ((VAL E$/VAL S$)*100);"■"
4420 PRINT
4422 GOTO 7000
4500 CLS
4502 PRINT "FINANCIAL EXP./SALES
:"
4504 PRINT ,,"FINANCIAL EXPENSES
=";
4506 INPUT E$
4508 PRINT E$
4510 PRINT "SALES=";
4512 INPUT S$
4514 PRINT S$
4516 IF S$="?" OR E$="?" THEN RU
N
4518 PRINT "FINANCIAL EXP./SALES
=";INT ((VAL E$/VAL S$)*100);"■
"
4520 PRINT
4522 GOTO 7000
4600 CLS
4602 PRINT "SALES+DISTRIB.EXP./S
ALES:"
4604 PRINT ,,"SALES+DISTRIB.EXP.
=";
4606 INPUT E$
4608 PRINT E$
4610 PRINT "SALES=";
4612 INPUT S$
4614 PRINT S$
4616 IF S$="?" OR E$="?" THEN RU
N
4618 PRINT "SALES+DIST. EXP./SAL
ES=";INT ((VAL E$/VAL S$)*100);"
■"
4620 PRINT
4622 GOTO 7000
4700 CLS
4702 PRINT "RESEARCH+DEV.EXP./SA
LES:"
4704 PRINT ,,"RESEARCH+DEV.EXP.=
";
4706 INPUT E$
4708 PRINT E$
4710 PRINT "SALES=";
4712 INPUT S$
4714 PRINT S$
4716 IF E$="?" OR S$="?" THEN RU
N
4718 PRINT "RESEARCH+DEV. EXP./S
ALES=";INT ((VAL E$/VAL S$)*100)
;"■"
4720 PRINT
4722 GOTO 7000
4800 CLS
4802 PRINT "FIXED ASSET TURNOVER
:"
4804 PRINT ,,"SALES=";
4806 INPUT S$
4808 PRINT S$
4810 PRINT "FIXED ASSETS=";
4812 INPUT F$
4814 PRINT F$
4816 IF S$="?" OR F$="?" THEN RU
N
4818 PRINT "FIXED ASSET TURNOVER
=";INT ((VAL S$/VAL F$))
4820 PRINT ,,"PRESS N/L TO CONTI
NUE"
4822 PAUSE 4E4
4824 GOTO 6500
4900 CLS
4902 PRINT "CURRENT ASSET TURNOV
```

```
ER:"
4904 PRINT ,,"SALES=";
4906 INPUT S$
4908 PRINT S$
4910 PRINT "CURRENT ASSETS=";
4912 INPUT C$
4914 PRINT C$
4916 IF S$="?" OR C$="?" THEN RU
N
4918 PRINT "CURRENT ASSET TURNOV
ER=";INT ((VAL S$/VAL C$))
4920 PRINT ,,"PRESS N/L TO CONTI
NUE"
4922 PAUSE 4E4
4924 GOTO 6400
5000 CLS
5002 PRINT "WORKING CAPITAL TURN
OVER:"
5004 PRINT ,,"SALES=";
5006 INPUT S$
5008 PRINT S$
5010 PRINT "WORKING CAPITAL=";
5012 INPUT W$
5014 PRINT W$
5016 IF W$="?" OR S$="?" THEN RU
N
5018 PRINT "WORKING CAPITAL TURN
OVER=";INT ((VAL S$/VAL W$))
5020 PRINT
5022 GOTO 7000
5100 CLS
5102 PRINT "DEBTORS TURNOVER:"
5104 PRINT ,,"CREDIT SALES=";
5106 INPUT S$
5108 PRINT S$
5110 PRINT "TRADE DEBTORS=";
5112 INPUT D$
5114 PRINT D$
5116 IF S$="?" OR D$="?" THEN RU
N
5118 PRINT "DEBTORS TURNOVER=";I
NT ((VAL S$/VAL D$))
5120 PRINT
5122 GOTO 7000
5200 CLS
5202 PRINT "RATE OF STOCK TURNOV
ER:"
5204 PRINT ,,"COST OF SALES=";
5206 INPUT C$
5208 PRINT C$
5209 IF C$="?" THEN RUN
5210 PRINT "OPENING STOCK=";
5212 INPUT S1
5214 PRINT S1
5216 PRINT "CLOSING STOCK=";
5218 INPUT S2
5220 PRINT S2
5222 IF S1=0 THEN LET S$=STR$ S2
5224 IF S2=0 THEN LET S$=STR$ S1
5226 IF S1<>0 AND S2<>0 THEN LET
 S$=STR$ (0.5*(S1+S2))
5228 PRINT "RATE OF STOCK TURNOV
ER=";
5230 LET X=INT (VAL C$/VAL S$)
5232 PRINT INT (365/X);"DAYS"
5234 PRINT
5236 GOTO 7000
5300 CLS
5302 PRINT "CURRENT ASSET RATIO:
"
5304 PRINT ,,"CURRENT ASSETS=";
5306 INPUT C$
5307 PRINT C$
5308 PRINT "CURRENT LIABILITIES=
";
5310 INPUT L$
5312 PRINT L$
5314 IF C$="?" OR L$="?" THEN RU
N
5316 PRINT "CURRENT ASSET RATIO=
";INT ((VAL C$/VAL L$));":1"
5318 PRINT
5320 GOTO 7000
5400 CLS
5402 PRINT "ACID TEST:"
5404 PRINT ,,"CURRENT ASSETS=";
5406 INPUT F$
5408 PRINT F$
5410 PRINT "STOCK=";
5412 INPUT S$
5414 PRINT S$
5416 PRINT "CURRENT LIABILITIES=
";
5418 INPUT L$
5420 PRINT L$
5422 PRINT "ACID TEST=";INT ((VA
L F$-VAL S$)/VAL L$);":1"
5424 PRINT ,,"PRESS N/L TO CONTI
NUE"
5426 PAUSE 4E4
5428 GOTO 6300
5500 CLS
5502 PRINT "AVERAGE PERIOD OF CR
EDIT GIVEN:"
5504 PRINT ,,"DEBTORS=";
5506 INPUT D$
5508 PRINT D$
5510 PRINT "CREDIT SALES=";
5512 INPUT C$
5514 PRINT C$
5516 IF C$="?" OR D$="?" THEN RU
N
5518 PRINT "AV.PERIOD OF CREDIT
GIVEN="
5520 PRINT "           ";INT ((VAL
 D$/VAL C$)*365);" DAYS"
5530 PRINT
5540 GOTO 7000
5600 CLS
5602 PRINT "AVERAGE PERIOD OF CR
EDIT REC""D:"
5604 PRINT ,,"CREDITORS=";
5606 INPUT C$
5608 PRINT C$
5610 PRINT "PURCHASES=";
5612 INPUT P$
5614 PRINT P$
5616 IF C$="?" OR P$="?" THEN RU
N
5618 PRINT "AV.PERIOD OF CREDIT
REC""D="
5620 PRINT "           ";INT ((VAL
 C$/VAL P$)*365);" DAYS"
5630 PRINT
5640 GOTO 7000
5700 CLS
5702 PRINT "EARNINGS PER SHARE:"
5704 PRINT ,,"NET PROFIT AFTER T
AX AND FIXED  INTREST=";
5706 INPUT N$
5708 PRINT N$
5710 PRINT "NO.OF ORD SHARES ISS
UED=";
5712 INPUT S$
5714 PRINT S$
5716 PRINT "EARNINGS PER SHARE="
;INT ((VAL N$/VAL S$)*100)
5718 PRINT
5720 GOTO 7000
5800 CLS
5802 PRINT "PRICE EARNINGS RATIO
:"
5804 PRINT ,,"MARKET PRICE PER S
HARE=";
5806 INPUT M$
5808 PRINT M$
5810 PRINT "EARNINGS PER SHARE="
;
5812 INPUT S$
5814 PRINT S$
5816 IF M$="?" OR S$="?" THEN RU
N
5818 PRINT "P.E.RATIO=";INT ((VA
L M$/VAL S$))
5820 PRINT
5830 GOTO 7000
5900 CLS
5902 PRINT "DIVIDEND PER SHARE:"
```

```
5904 PRINT ,,"DIVIDEND PAID=";
5906 INPUT D$
5907 PRINT D$
5908 PRINT "NO.OF SHARES=";
5910 INPUT N$
5920 PRINT N$
5925 IF D$="?" OR N$="?" THEN RU
N
5930 PRINT "DIVIDEND PER SHARE="
;INT ((VAL D$/VAL N$))
5932 PRINT
5934 GOTO 7000
6000 CLS
6002 PRINT "DIVIDEND YIELD:"
6004 PRINT ,,"DIVIDEND PER SHARE
=";
6006 INPUT D$
6008 PRINT D$
6010 PRINT "MARKET PRICE PER SHA
RE=";
6012 INPUT M$
6014 PRINT M$
6016 IF D$="?" OR M$="?" THEN RU
N
6018 PRINT "DIVIDEND YIELD=";INT
 ((VAL D$/VAL M$)*100);" █"
6020 PRINT
6022 GOTO 7000
6100 CLS
6102 PRINT "DIVIDEND COVER:"
6104 PRINT ,,"NET PROFIT - TAX -
 FIXED INTREST  - PREF.DIVIDEND=
";
6106 INPUT D$
6108 PRINT D$
6110 PRINT "DIV.PAID ON ORD.SHAR
ES=";
6112 INPUT M$
6114 PRINT M$
6116 PRINT "DIVIDEND COVER=";INT
 ((VAL D$/VAL M$))
6118 PRINT
6120 GOTO 7000
6200 CLS
6202 PRINT "CAPITAL EMPLOYED:"
6204 PRINT ,,"SHARE CAPITAL=";
6206 INPUT B$
6208 PRINT B$
6210 PRINT "RESERVES=";
6212 INPUT C$
6214 PRINT C$
6216 PRINT "LONG TERM LIABILITIE
S=";
6218 INPUT D$
6220 PRINT D$
6222 PRINT "INTANGIBLE ASSETS=";
6224 INPUT E$
6226 PRINT E$
6228 PRINT "CAP.EMPLOYED=";((VAL
 C$+VAL D$+VAL B$)-VAL E$)
6230 PRINT
6240 GOTO 7000
6300 CLS
6305 PRINT "ACID TEST:"
6310 PRINT "TOO MUCH RESOURCES B
EING HELD INLIQUID FORM AND THER
EFORE NOT  CONTRIBUTING TO FIRM
S PROFITS."
6320 PRINT ,,"EXAMPLES SUCH AS:"
6330 PRINT ,,"     1) CASH AT BANK,
 AND           2) DEBTORS."
6340 PRINT AT 20,0;"PRESS J,N/L
TO STOP OR                   N/L
TO RE-START"
6350 INPUT J$
6360 IF J$="J" THEN STOP
6370 RUN
6400 CLS
6405 PRINT "CURRENT ASSET TURNOV
ER:"
6410 PRINT "A FALL IN CURRENT AS
SET TURNOVERINDICATES A PROBLEM
IN SALES OR CURRENT ASSETS:"
```

```
6420 PRINT ,,"THERE IS ALSO A PO
SSIBILITY OF  ""UNDERTRADING""."
6440 PRINT AT 20,0;"PRESS J,N/L
TO STOP OR                   N/L
TO RE-START"
6450 INPUT J$
6460 IF J$="J" THEN STOP
6470 RUN
6500 CLS
6505 PRINT "FIXED ASSET TURNOVER
:"
6510 PRINT "A FALL IN F.A.TURNOV
ER INDICATESUNDERUTILISATION OF
CAPACITY."
6515 PRINT " -EG:PLANT MAY BE TO
O BIG IN          RELATION TO VOL
UME OF SALES"
6520 PRINT ,,"      TOO RAPID EXPA
NSION"
6525 PRINT ,,"      ANTICIPATE█ DE
MAND FOR SALES     IS JUST NOT TH
ERE."
6540 PRINT AT 20,0;"PRESS J,N/L
TO STOP OR                   N/L
TO RE-START"
6550 INPUT J$
6560 IF J$="J" THEN STOP
6570 RUN
6600 CLS
6605 PRINT "NET+GROSS PROFIT RIS
E:"
6606 PRINT
6610 PRINT "INDICATES OVERTRADIN
G AND A      DELAY BETWEEN PAYMEN
T OF DEBTS   AND RECEIPT OF MONEY
 OWED."
6620 PRINT ,,"REMEDIES FOR FALLI
NG           PROFIT PERCENTAGES
:"
6625 PRINT
6630 PRINT "1)  INCREASE SELLING
PRICE         2)  TIGHTEN SECURITY
ON CASH           AND STOCK
              3)  CHECK ON SLOW MOV
ING STOCK"
6635 PRINT "4)  CHECK STOCK VALUA
TION METHODS5)  CHECK STAFF EFFIC
IENCY         6)  FIRE BUYER AND/OR
 SALES            MANAGER"
6640 PRINT AT 20,0;"PRESS J,N/L
TO STOP OR                   N/L
TO RE-START"
6650 INPUT J$
6660 IF J$="J" THEN STOP
6670 RUN
7000 PRINT "PRESS J,N/L TO END
                     N/L TO RE-ST
ART"
7010 INPUT J$
7020 IF J$="J" THEN STOP
7030 RUN
7040 PRINT END
9000 CLS
9010 PRINT "*********************
***********"
9020 PRINT "*";TAB 31;"*"
9030 PRINT "*  ZX81 PROFITABILIT
Y RATIOS     *"
9040 PRINT "*";TAB 31;"*"
9050 PRINT "*      BY MICHAEL CAR
ROLL         *"
9060 PRINT "*";TAB 31;"*"
9070 PRINT "*      RUNS ON A ZX81
 IN 16K      *"
9080 PRINT "*";TAB 31;"*"
9090 PRINT "*          USES APPROX
.10K         *"
9100 PRINT "*";TAB 31;"*"
9110 PRINT "*********************
***********"
9120 PRINT AT 15,0;"PRESS NEWLIN
E TO CONTINUE..."
9130 INPUT A$
9140 RETURN
```

If you missed out on Breadboard '79, '80, '81 and '82 . . . . Now's the time to catch up with

BREADBOARD '83

Friday November 25th — 10am - 6pm
Saturday November 26th — 10am - 6pm
Sunday November 27th — 10am - 4pm

Improved venue

We have transferred Breadboard to Cunard International Exhibition Centre, so that we can offer improved facilities to the visitor, including car parking and ease of access by rail, tube and car, all in a modern attractive setting. We have also arranged a reduced hotel/rail fare package to attract enthusiasts from all parts of the country.

Planned features include

1. Full range of lectures planned over 3 days to cover most aspects of electronics and computing.
2. Electronics/Computing Advice Centre — manned by experts.
3. Demonstration of electronic organs and synthesisers.
4. Holography presentation.
5. Practical Demonstration on "How to produce printed circuit boards".
6. Computer Corner — extensive display of computer hardware — "Try Before You Buy".
7. Amateur radio Action Centre.
8. Computer controlled model railway competition.
9. Pick of the Projects — Demonstration of the best from ELECTRONICS TODAY INTERNATIONAL, HOBBY ELECTRONICS and ELECTRONICS DIGEST over the past ten years.
10. Giant T.V. screen video games.
11. Robotic display.

Why not bring the family to the show and enjoy a weekend in London? We have arranged a complete hotel package for our visitors to the exhibition. All inclusive rail tickets also available. Send now for details of what *we*, the organisers, can offer *you*.

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Software Machine (London SE5 01-305 0521)
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Hobbyhome (Lincoln 0522 35227)
Micro Home Computers (Orkney 0856 3285)

The soft touch

The heavens have opened and showered James Walsh with a wealth of software for his Spectrum. Read on and find out what he thought of it all . . .

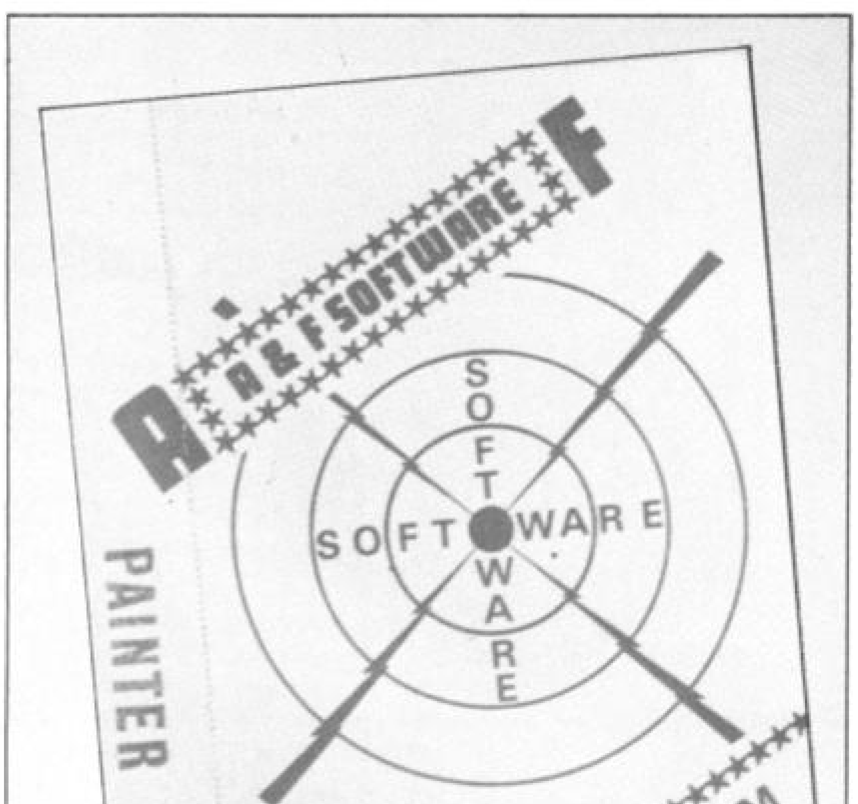
Painter — A&F Software

The first thing that can be said about Painter is that it certainly is different! This does, in turn, make it rather more difficult to explain.

The object of the game is run around a maze of paint pots on the screen and in turn fill them up with paint. This is whilst being chased by at least one roller, and making sure that you do not run out of paint. If you succeed in filling each pot then you play again but with two rollers chasing you, and so it goes on.

This is a novel game, using the properties of the Spectrum well. It may not be the most innovative program of this review, but it is one of the most enjoyable to play. The graphics are good, and the movement smooth. A game well worth playing, though I feel £7.00 is a little steep!

One characteristic of all A&F *Software so far is that* though it may be good, the plain packaging prevents it making sufficient impact on the shelf. A shame . . .





The Dungeon Master — Crystal Computing

The Dungeon Master is nicely packaged with a large booklet of well thought out documentation. The concept of this game will be better known to the players of the traditional 'Dungeons and Dragons' games rather than the adventure games which are widely available for the Spectrum. This is, in fact, the first attempt to put the real 'D&D' game onto the Spectrum. Needless to say, it uses the full 48K of memory. This is partly due to the fact that it is written totally in BASIC, but also because the author has done his best to cram as much of the game onto the computer as possible. Obviously you cannot expect a full version on such a relatively limited computer as the Spectrum.

The game is based on the development of a character whose fate is determined by his own actions. The character is trapped in a dungeon and has to conquer many challenges. Though this is a totally text game, its main difference is the fact that you can define your own dungeons as well as dangers. Hence the limits of the game extend as far as your imagination. On the tape there is a sample 140 location dungeons for your use.

This cassette must be highly recommended for its versatility, originality and quality. For an avid adventure player this is definitely well worth obtaining.

Jetpac — Ashby Computers and Graphics Ltd

The idea of this game is that you are an astranaut and your object is to collect as many of the valuable minerals, etc, of the planet which you are on, whilst also collecting fuel for your safe departure. Though the scenario is not the most original around, what puts it to number one in this review is the fantastic quality of the graphics. The characters are beautifully designed and colour is used very well indeed. But the thing that really caught my eye was the incredible smoothness of it all. Never in the game will you see one jerky move. As you get to more



planets the inhabitants get more and more determined to stop you. Another nice feature is the way in which, as you proceed through the game, your rocket turns into the space shuttle — a nice touch.

There are five controls to be mastered: left, right, fire, thrust and hover. All of which maybe controlled via the keyboard or through a joystick.

Overall this is a very well put together piece of software. If you want a game with impact then this is one of the best around. An excellent program and game.

3D Tanx — dk'Tronics

The idea of the game is to destroy the 2D tanks which are moving from right to left across the screen, using your 3D gun turret. There are three levels of play, one or two player options, a hold feature, demo and training modes. One particularly nice feature is that you are allowed to pick your own control keys. Just to make it more difficult the tanks can actually fire back at you.

Colour is used well in this game, but whilst the detail of the graphics is good, the tanks still only move one character square at a time which does look rather jerky. The gun turret looks very good and moves very well indeed whilst you aim. Probably the most advanced feature of this game is the semi-recoil of the nozzle of the gun, going down each time you fire.

To conclude, it can be said that though the standard of 3D Tanx is not quite the best in this review, it is an addictive and entertaining game. Well recommended.

Dietron — Custom Data Ltd

Dietron is the only program in this review which is definitely not a game. It has a number of major functions: 1 — to work out your maximum advised weight and intake of calories according to your height, build, age, sex, etc, and 2 — it holds data on an enourmous number of different foods, so that it is possible to plan a balanced meal. The data available includes protein, fibre, vitamins, etc; this section is a very comprehensive catalogue indeed.

It is also possible to load in a second program which holds information on dieting, as well as how quickly you are likely to lose those precious pounds if you cut down by a chosen amount of calories. It also explains the value of each vitamin for which data has been given for the different foods. More specifically it gives details about them, as well as the consequences of too much or too little in your diet.

This is well written and researched program which can be useful for anyone who is interested in their diet. There is a substantial amount of data in Dietron which is well worth having and using. Though all of this can be found in a book, it has been arranged in such a way that makes it far quicker and easier to use on your Spectrum.

Cosmic Guerrilla — Crystal Computing

This is a new, original and fast, 100% machine code arcade type game. The object of the game is to protect your laser bases from the marauding aliens which slowly eat away your defences. The aliens are lined up vertically on either side of the screen, with your bases vertically lined up in the centre. The aliens smoothly walk towards the centre and collect the objects which are the only defence your bases have. Your task is to zap the aliens with the laser running horizontally along the bottom of the screen.

Though Cosmic Guerrilla does have some parallels with the 'space invaders' type games, the screen arrangement and the different scenarios put it way ahead in my view. One quality of 'Space Invaders' that it does unashamably possess, is its incredible addictive quality.

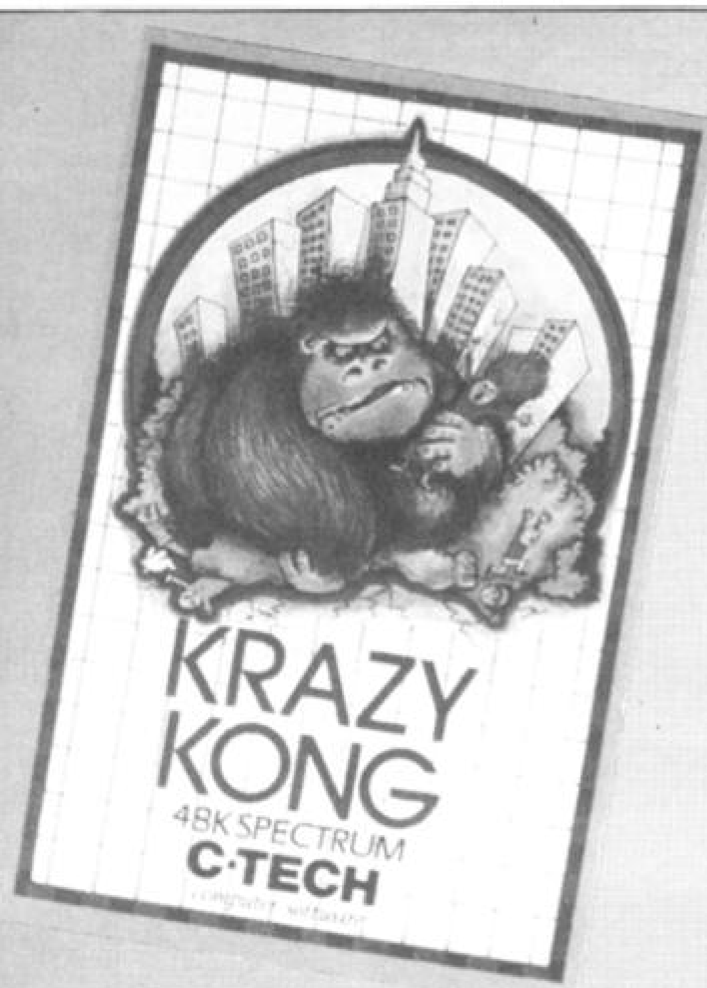
Amongst other things the graphics are good, as well as smooth, plus good sound and colour. This is a very playable game indeed. For all those who have enjoyed Space Invaders, then this is the next step up. Highly recommended.

The Black Hole — Quest Microsoftware

The idea of the game is that alien space craft are using the Black Hole to gain entrance to other galaxies. Unfortunately their intent is destructive, hence your task is to inflict as much damage on them as you possibly can. You have two weapons, the Positive and Negative Ion gun, and a Neutron Blaster. The large scale advertising campaign that Quest have launched for this program seems to suggest some amazing graphics. Yes the graphics are good, but



personally, I found the 2D effect rather confusing because it just doesn't look right. However, all in all, not a bad piece of software.





Krazy Kong — Control Technology

Kong the gorilla has captured a girl and your task is to rescue her from his evil grasp. There are three stages of this game: first you must avoid the barrels and fireballs which are being hurled at you and climb the ladders to the second screen. Then you must climb the staircase again avoiding the fireballs to rescue the girl. It is left up to your own imagination to decide who the fair maiden in distress is, so you can be the in-house hero!

Being written in machine code means that the action is pretty fast, though jerky and a little crude. Some of the controls are a little too sensitive, but apart from that it is a good, fun game, which can be played for hours — just change the maiden!

Blind Alley — Sunshine Books Ltd

The instructions on the back of the box tells that this game is a deadly duel, deep in space — the sport of the year 3017.

The idea is to trap your opponent or opponents by enclosing them in the trail that you have left. It is rather like the game in the movie, **Tron**. The graphics of the introductory screen are good, though the graphics of the rest of the game are less than brilliant. Though there is only one level of play it does get progressively more difficult, with more and more opponents sent against you.

Sunshine seem to have a habit of producing games which are not technically brilliant, but manage to be highly addictive and great fun to play.

Frenzy — Quicksilva

As soon as you see a Quicksilva game on the shelves of a shop or advertised you do expect it to be pretty good — they have a name to live up to. In this game you have been placed in a room with walls segmenting it, which is also inhabited by robots. Unfortunately they seem intent on killing you.

There are various special features, including different levels of robots, exploding pods and minelayers. The main disappointment comes when you see the screen display, which is rather dull, with all the robots, etc, taking up exact character squares. If you hit a wall you die — though it is possible to escape through a hole in the outer wall and then you find yourself in a new room with more robots.

I didn't think Frenzy was really up to QS's usual high technical standard, though it is still quite fun to play.

Alien Swarm — Titan Software

This is very much another version of the 'Galaxians' game. The idea is to kill off the swarms of aliens which proceed down the screen at you. Every so often the PAPER/INK colours change, making for some pretty weird combinations. After a while you are even lucky enough to get different shaped aliens.

Though Alien Swarm may be quite well written, it cannot compete with the other 'Galaxians/Invaders' clones such as Imagine's Arcadia, which I reviewed two issues back.

Overall this game may be quite fun but rather predictable and not very innovative.

Roulette — Micromega

It doesn't take much in the way of grey matter to work out what this game is all about. Unlike most previous versions of roulette for the Sinclair computer it does give you a good range of options, ie odds, evens, blacks, column, etc, and you can bet on a combination of these.

This is a well put together program with no real surprises except for the pretty screen display when the wheel is spun. If you like this type of game then you'll find Micromega's version a pretty safe bet.

UK Map — Kuma

Map of UK has recently been released by Kuma in a rather bigger than usual package — more along the lines of VIC software packaging.

Aimed mainly at the educational market this program produces a large map of the UK, a tour of which may be obtained by pressing the right keys. It is also possible to instruct the computer to search for a particular place. Fortunately, it does hold a reasonable number of places but for some reason county names have been omitted. There is also an inbuilt game in which you are in a balloon floating over the British Isles — quite an interesting diversion.

This is a useful educational package which I would recommend for the classroom.

The Knights Quest — Phipps Associates

This is one of the few adventure games with a decent amount of in-built graphics. Having a picture or map of your location does make a great deal of difference to an adventure game.

The screen itself is split into graphics and text, though often there is only text. The object of the game is to find the lost treasures whilst rescuing a Princess held by a witch (another chance to be a hero), and battling against various evils including scorpions, elves, etc. The Knights Quest follows the tradition of Phipps games by being extensive in detail and length and a pleasure to play.

As far as adventures go I feel confident to recommend Knights Quest most highly.

Spectrum Special 1 — Shiva Software

All the programs on this cassette are enhanced versions of some described in their range of books for the Spectrum.

There are ten programs: Sink the Bismark, Wolf Puzzle, Character Builder, Tiger Hunt, Pie Chart, St. Moritz, Hidden Words, Towers of Hanoi, Picasso and Statistics Made Simple. All these are very obviously book-type programs because they are very simple and relatively unimaginative. However, all the programs work reasonably well and illustrate various techniques of programming included in the books.

This cassette can only really be recommended as a supplement to the books if you do not wish to type the programs in.

Panic — Mikrogen

Panic is very similar indeed to the ladders type arcade game. An almost identical version is available for the BBC under the name 'Monsters'. Though Panic may not be 100% original as a game, it is very well written indeed.

The idea is that you are caught in a maze of walls and ladders with a load of rather nasty aliens. The object is to lure them into holes which you have dug and then bang them over the head until they die. As if this wasn't enough you are in danger of running out of oxygen. As time goes on, and especially if an alien gets through a hole without getting hit, they get even more ferocious and difficult to kill.

Maybe not original, but this is the first time I have seen it for the Spectrum. It is definitely a highly addictive and enjoyable game to play.





Name	Price	Memory	Documentation	Addictive quality	Graphics	Programming acheivement	Lasting appeal	Value
Frenzy	4.95	16K	3½	3	2	2	2	3
Roulette	4.95	16K	3	3½	3	3½	3½	3½
Map of UK	11.95	48K	3½	3	2½	3	3½	3½
Dungeon Master	6.95	48K	5	4½	2½	4½	5	4½
Cosmic Guerilla	5.95	16K	3½	4½	4	4	4½	4
Painter	7.00	16K	2½	4	4	4	4	4
Knights Quest	5.95	48K	3	4	4	4	4	4
Krazy Kong	5.00	48K	3½	3½	3	3½	3	3½
Jetpac	5.50	16K	4½	4½	5	4½	4½	4½
Black Hole	5.50	16K	3	3	3½	3½	3½	3½
Dietron	4.75	48K	4½	4	—	4	4½	4½
Blind Alley	4.95	16K	3½	4	3	3	4	4
3D Tanx	4.95	16K	3	4	4	4	3½	4
Spectrum Special 1	5.95	16K	3	2	3	2	3	3
Panic	5.95	16K	3½	4	4	3½	4	4
Alien Swarm	4.95	16K	3½	3	3	3	3	3

Addresses of suppliers

A&F Software, 830 Hyde Road, Gorton, Manchester.
Kuma Computers Ltd, 11 York Road, Maidenhead, Berks.
dk'Tronics, 23 Sussex Road, Gorleston, Gt. Yarmouth, Norfolk.
Sunshine Books Ltd, Mobhouse Court, 19 Whitcomb Street, London WC2 7HF.
Phipps Associates, 99 East Street, Epsom, Surrey KT17 1EA.
Control Technology, 184 Market Street, Hyde, Cheshire.
Quest Microsoftware, 119 The Promenade, Cheltenham, Gloucestershire.
Ashby Computers and Graphics Ltd, The Green, Ashby de la Zouch, Leicestershire.
Quicksilva Ltd, Palmerston Park House, 13 Palmerston Road, Southampton SO1 1LL.
Shiva Publishing Ltd, 4 Church Lane, Nantwich, Cheshire.
Micromega, 230-236 Lavender Hill, London SW11 1LE.
Crystal Computing, 50 Charles Close, Wroxham, Norwich NR12 8TU.
Mikrogen, 24 Agar Crescent, Bracknell, Berks.
Titan Software, The Computer Palace, 46 Market Place, Chipperton, Wilts.
Custom Data, 20 Friars Quay, Colegate, Norwich NR3 1ES.

3D mover

Creating a three-dimensional image on your 16K ZX81 is not as difficult as you might imagine with this program from Mr DJ Munro of Coleraine.

I have been interested for some time in trying to get a program to RUN on the ZX81 which displayed a solid object rotating in space giving a three-dimensional effect.

The program, once typed in, requires a full five minutes RUNing time to complete the POKEing of each of the six picture frames. The program will then automatically begin. The display is quite realistic — there is no screen flicker or jumping — and shows a rotating rectangle, spinning on a fixed axis. The rotational effect lasts for around 30 seconds and looks something like the illustration shown in Fig. 1.

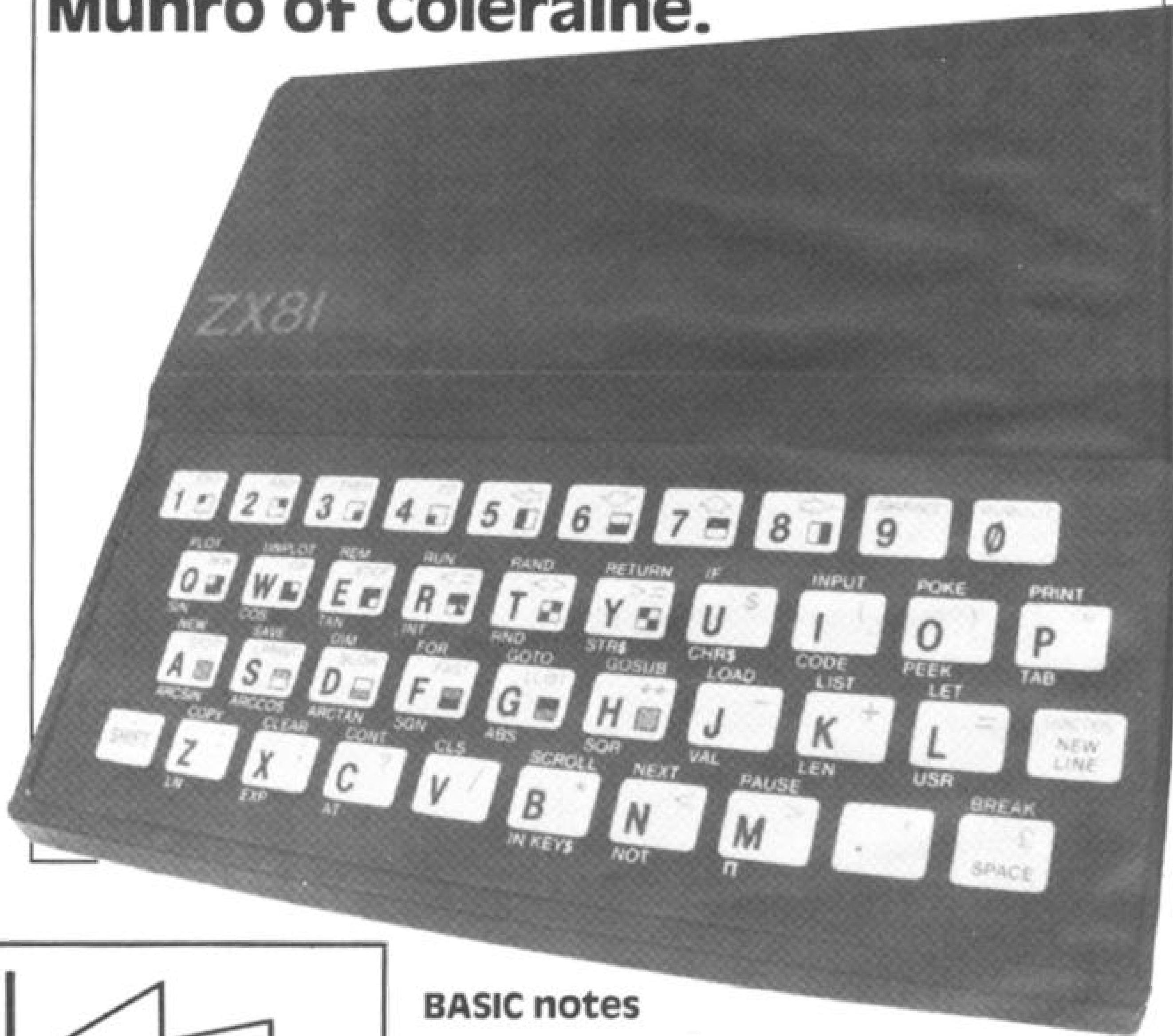
Shapes of things

The shape of the figure is easily altered by changing the co-ordinates, X( ) and Y( ) in lines 140 to 600. (You'll need to do this on plotting paper though.)

One restriction of the program is that only the top half (lines 0 to 10) can be used. When I first developed the program, I tried to use the whole screen but I ran out of memory (even with the 16K RAM Pack attached!).

Once you have the program entered into the machine, it should be SAVEd before you attempt to RUN it. Once it has been RUN, any new instructions have to be typed in 'blind' as the PRINT position has been moved down below line 23 of the screen. If you want to re-RUN the program, you should type in 'GOTO 1000'; this will also have to be done 'blind'.

As a final point, the insertion of a '£' sign at lines 630 and 650 is to end each frame with a code signal for the operating machine code to recognise the end of a frame, and the end of the last (the sixth) frame.



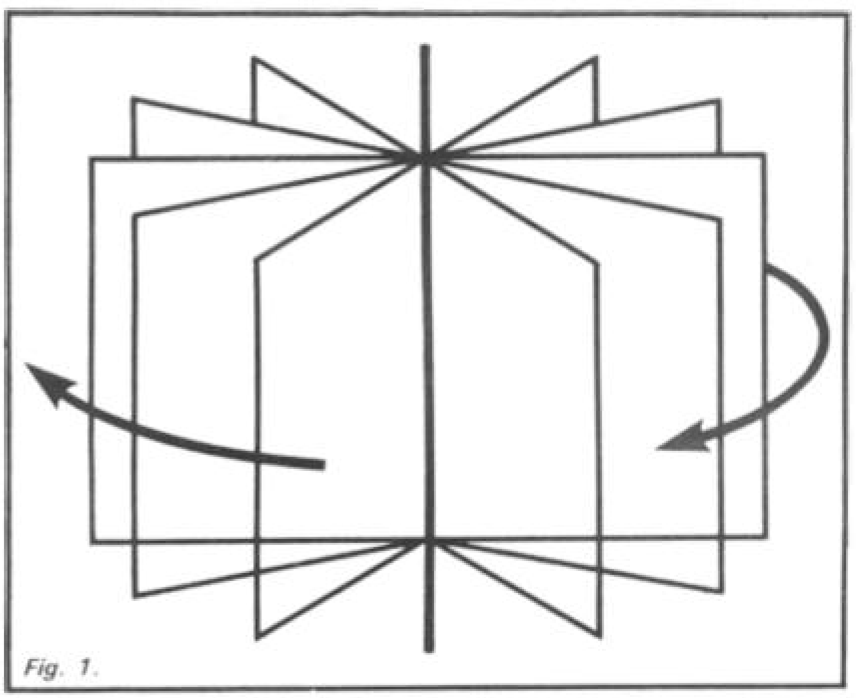


Fig. 1.

BASIC notes

Here is a breakdown of the BASIC part of this listing:

Lines 140-600	Initialisation — co-ordinates of the corners of each wire frame (there are six frames altogether).
SUB 4010	Enters the operating machine code starting at address 30000 from A$. Leaves A$ as an empty string.
SUB 1500	SUB 2500 and SUB 3000. Prints the picture of each of the six frames in turn.
Lines 660-800	Convert the picture frame into Hex code and store code in a character string (A$).
SUB 4070	POKEs the Hex code into memory starting at the address after the operating code (address 30042) and leaves A$ as an empty string ready for the next frame.
Lines 1010-1060	Calls up the display with RAND USR 30000.

1E FF	LD E,255	Initialisation to repeat cycle 255 times; can be shortened by POKEing smaller numbers to address 30001.
1D	DEC E	
7B	LD A,E	
FE 00	CP 0	
C8	RET IF ZERO	
2A 0C 40	LD HL(16396)	Start of screen display.
01 5A 75	LD BC 30042	Set address of first data bit of first frame.
0A	LD A(BC)	
77	LD(HL)A	Prints it.
23	INC HL	Next screen position.
03	INC BC	Next data bit.
0A	LD A(BC)	
FE 0C	CP 12	Compare it to '£'.
20 F8	JR NZ 8 steps back	If not '£', print it and continue with next data.
03	INC BC	Next data bit.
0A	LD A(BC)	
FE 0C	CP 12	Compare it to '£'.
28 E6	JR Z 26 steps back	If it is '£', return to start and repeat the cycle. If not '£', delay after printing first frame.
16 02	LD D,02	Delay — POKEing larger number than two at address 30029 will reduce the speed of rotation.
15	DEC D	
7A	LD A,D	
FE 00	CP 0	
20 FA	JR NZ 6 steps back	
2A 0C 40	LD HL(16396)	GO TO screen and start again.
0A	LD A(BC)	
18 E4	JR 28 steps back	

The machine code part of the listing.

The BASIC part of the listing.

```
  20 CLS
  30 REM "3DMOVER"
  40 FAST
  50 DIM X(24)
  60 DIM Y(24)
  70 LET P=0
  80 LET B$=""
  90 LET C$=""
 100 LET D$=""
 110 LET E$=""
 120 LET F$=""
 130 LET G$=""
 140 LET X(1)=20
 150 LET X(2)=40
 160 LET X(3)=20
 170 LET X(4)=40
 180 LET X(5)=23
 190 LET X(6)=37
 200 LET X(7)=23
 210 LET X(8)=37
 220 LET X(9)=26
 230 LET X(10)=34
 240 LET X(11)=26
 250 LET X(12)=34
 260 LET X(13)=31
 270 LET X(14)=30
 280 LET X(15)=31
 290 LET X(16)=30
 300 LET X(17)=26
 310 LET X(18)=34
 320 LET X(19)=26
 330 LET X(20)=34
 340 LET X(21)=23
 345 LET X(22)=37
 350 LET X(23)=23
 360 LET X(24)=37
 370 LET Y(1)=39
 380 LET Y(2)=39
 390 LET Y(3)=26
 400 LET Y(4)=26
 410 LET Y(5)=42
 420 LET Y(6)=36
 430 LET Y(7)=29
 440 LET Y(8)=23
 450 LET Y(9)=43
 460 LET Y(10)=35
 470 LET Y(11)=30
 480 LET Y(12)=22
 490 LET Y(13)=43
 500 LET Y(14)=35
 510 LET Y(15)=30
 520 LET Y(16)=22
 530 LET Y(17)=35
 540 LET Y(18)=43
 550 LET Y(19)=22
 560 LET Y(20)=30
 570 LET Y(21)=36
 580 LET Y(22)=42
 590 LET Y(23)=23
 600 LET Y(24)=29
 605 GOSUB 4010
 610 FOR J=1 TO 21 STEP 4
 620 GOSUB 1500
 630 PRINT AT 10,31;"£"
 640 LET P=P+1
 650 IF P=6 THEN PRINT AT 10,30;
"£"
 660 LET A=PEEK 16396+256*PEEK 1
6397
 665 LET A$=""
 670 FOR B=0 TO 363
 680 LET S=PEEK (A+B)
 690 LET H=INT (S/16)
 700 LET L=(S/16-H)*16
 710 LET L$=CHR$ (L+28)
 720 LET H$=CHR$ (H+28)
 730 LET A$=A$+H$+L$
 790 NEXT B
 800 CLS
 810 GOSUB 4070
 820 NEXT J
1010 CLS
1020 SLOW
1040 RAND USR 30000
1060 STOP
1500 FOR I=J TO J+3 STEP 2
1510 GOSUB 2500
1520 NEXT I
1530 FOR I=J TO J+1
1540 GOSUB 3000
1550 NEXT I
1560 RETURN
2500 LET M=(Y(I)-(Y(I+1)))/(X(I)
-(X(I+1)))
2510 LET C=Y(I)-(M*X(I))
2520 FOR X=X(I) TO X(I+1)
2530 PLOT X,(M*X)+C
2540 NEXT X
2550 RETURN
3000 FOR Y=Y(I+2) TO Y(I)
3010 PLOT X(I),Y
3020 NEXT Y
3024 FOR Y=22 TO 43
3026 PLOT 30,Y
3028 NEXT Y
3030 RETURN
4010 REM "STARTING ADDRESS=30000
"
4020 LET A$="7530"
4030 GOSUB 5000
4060 LET A$="1EFF1D7BFE00C82A0C4
0015A750A7723030AFE0C20F8030AFE0
C28E61602157AFE0020FA2A0C400A18E
4"
4070 IF A$="" THEN RETURN
4100 POKE Z,16*CODE A$+CODE A$(2
)-476
4110 LET Z=Z+1
4120 LET A$=A$(3 TO )
4130 GOTO 4070
5000 LET Z=4096*CODE A$+256*CODE
 A$(2)+16*CODE A$(3)+CODE A$(4)-
122332
5010 RETURN
5020 STOP
```

Bats



Here's a batty program for your 16K Spectrum from Colin Gooch of Ilminster.

In this program, you are a bat flying about trying to secure some moths for your supper. Movement is made via the four 'arrow' keys on the Spectrum, and to make a catch you have to place the centre of the bat character directly over the moth. Watch out though — the moth moves totally at random.

Because your bat cannot fly in bright light, the moth can escape you by flying into the lighted window in the top left-hand corner of the screen. All you have to do is to trap the moth before it gets there! The game ends when you have attempted to catch ten moths, although there is a bonus if you manage to catch all ten.

Holy bat-catcher!

Initialisation of the graphics is done in lines 2230 to 2250. This leads straight into the instruction page which is completed by lines 2300 to 3030. This last section is not repeated when you play subsequent games after your first.

The main program begins with line 50 which calls the subroutine to print the screen display, followed by lines 90 to 120 which initialise the screen co-ordinates for the bat and the moth. Lines 200 to 300 are a loop which constantly moves the position of the moth, and if the right keys are pressed this section of the program actually moves the bat.

The conditional statements for the moth make sure that it stays within the screen area and also reverse its direction should it get too near to the edge. The moth is moved 'dx' and 'dy' across and up the screen, but it is not incremented on each pass of the loop. It is the RND value in lines 230 and 240 which look after this latter task, and it is this which gives the moth its random movement.

The conditional statements for the bat read the keyboard, keep the bat on the screen and also ensure that it will not move into the area of the window. Line 320 detects a caught moth and moves on to the scoring section of the program. Lines 330 to 350 detect the moth in the vicinity of the window, and once there it is automatically drawn into the window, the moth's home score is updated and a new moth appears down in the bottom right-hand area of the screen.

Scoring is carried out from lines 370 to 520. This includes a 'high score' routine, and offers you a bonus 'go' if you managed to catch ten moths out of ten. This invitation comes courtesy of lines 530 to 580.

Flying tonight

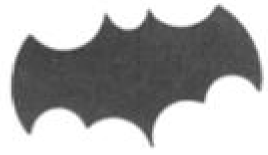
The REM at line 20 indicates which lines need letters typed in the graphics mode. Lines 250 and 260 use keyboard graphics and it is important that you get four blanks at the end of each string.

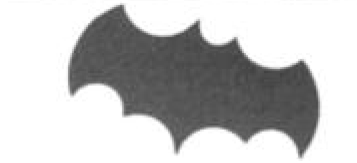
Line 3400 looks the most complicated. However, if you decide that you don't want to put a title or instructions in your listing, you could always re-write line 2400 to read:

```
2400 RETURN
```

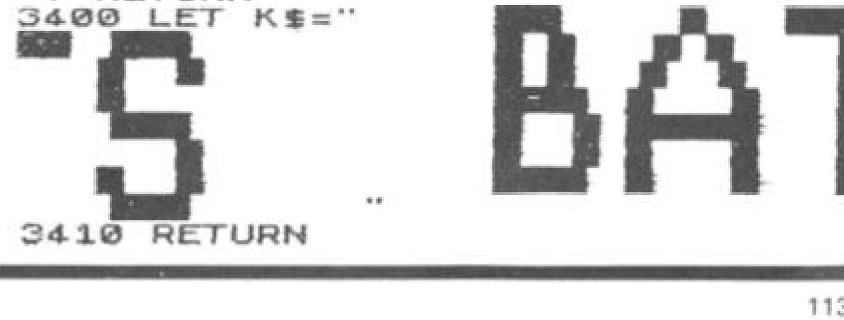
and omit all from thereon.

```
   9 REM ************************
  10 REM BATS by C N GOOCH
  11 REM ************************
  20 REM In lines 250,300,570,23
00 the letters to be printed are
those letters in GRAPHICS mode
  30 RANDOMIZE : CLS : BORDER 1:
 LET HSC=0: GO SUB 2200
  40 PAPER 5: CLS : LET TET=0: L
ET ET=0: LET MO=0
  50 GO SUB 2050
  90 LET xx=16: LET yy=20
 100 LET y=12+INT (RND*5): LET x
=0: IF RND>.4 THEN LET X=31
 120 LET dx=1: LET dy=1
 190 REM MOVE MOTH
 200 LET dx=((x=0)-(x=31)+dx*(x>
0 AND x<31))
 210 LET dy=(y=0)-(y=20)+dy*(y>0
AND y<20)
 220 PRINT AT y,x; PAPER 5+1*(X<
8 AND Y 8);" "
 230 I  RND>.6 THEN LET x=x+dx
 240 IF RND>.5 THEN LET y=y+dy
 250 PRINT AT y,x; PAPER 5+1*(X<
7 AND Y<7);"A"
 260 REM MOVE BAT
 270 PRINT AT yy,xx;"   "
 280 LET yy=yy+((INKEY$="6" AND
yy<20)-(INKEY$="7" AND yy>0))*(Y
Y>8 OR XX>8 OR INKEY$="6")
 290 LET xx=xx+((INKEY$="8" AND
xx<29)-(INKEY$="5" AND xx>0))*(Y
Y>8 OR XX>8 OR INKEY$="8")
 300 PRINT AT yy,xx;"BCD"
 310 REM MOTH CATCH OR HOME
 320 IF x=xx+1 AND y=yy THEN GO
TO 370
 330 IF Y<8 AND X<8 THEN LET DX=
-1: LET DY=-1
 340 IF X<4 AND Y<4 THEN GO SUB
2080: LET MO=MO+1: PRINT AT 1,1;
 PAPER 7;MO: IF MO=10 THEN GO TO
 410
 350 IF X<4 AND Y<4 THEN GO TO 1
00
 360 GO TO 200
 370 REM MOTH CAUGHT
 380 IF INKEY$<>"" THEN GO TO 38
0
 390 LET ET=ET+1: PRINT AT 21,5;
 INK 7; PAPER 2; BRIGHT 1;" MOTH
S CAUGHT ";ET: PAUSE 100: IF ET>
=10 THEN GO TO 450
 400 GO TO 100
 410 REM **END ROUND**
 420 LET TET=TET+ET: IF ET=10 AN
D MO=0 THEN PRINT AT 15,0; PAPER
 4;" IT'S A GOOD NIGHT FOR HUNTI
NG ";AT 17,10; PAPER 2; INK 7;
BRIGHT 1; FLASH 1;" CARRY ON ":
IF INKEY$<>"" THEN GO TO 420
 430 IF ET=10 AND MO=0 THEN PAUS
E 400: FOR N=15 TO 17 STEP 2: FO
R M=0 TO 31: PRINT AT N,M; PAPER
 5;" ": NEXT M: NEXT N: GO TO 10
0
 480 IF TET>HSC THEN LET HSC=TET
 490 PAPER 4: CLS : PRINT AT 5,0
; PAPER 6;" YOUR SCORE THAT ROU
ND WAS "'" ";ET;" MOTHS EATE
N ";MO;" MOTHS ESCAPED "
 500 IF TET>10 THEN PRINT AT 7,0
; PAPER 6;" YOUR TOTAL SCORE WAS
 ";TET
 510 IF ET>HSC THEN LET HSC=ET
 520 PRINT AT 10,6; PAPER 3; INK
 0;" HIGHEST SCORE SO FAR ";HSC
 530 PRINT AT 12,4; PAPER 6;" DO
YOU WANT ANOTHER GO ?";AT 13,4;
" PRESS ""Y""es TO CONTINUE ";AT
 14,4;" ""N""o TO STOP OR ""C""h
ange";AT 15,4;" TO GO TO NEXT GA
ME "
```





```
 540 IF INKEY$="Y" OR INKEY$="y"
 THEN CLS : GO TO 40
 550 IF INKEY$="N" OR INKEY$="n"
 THEN GO TO 570
 555 IF INKEY$="C" OR INKEY$="c"
 THEN CLS : PRINT AT 10,10; FLA
SH 1; PAPER 6;" START THE TAPE "
: LOAD ""
 560 GO TO 540
 570 CLS : FOR N=0 TO 21 STEP 2:
 FOR M=0 TO 31 STEP 4: PRINT AT
N,M;"BCD": NEXT M: NEXT N
 580 PRINT AT 10,4; INK 7; PAPER
 1; BRIGHT 1; FLASH 1;" BYE BY
E ";AT 14,12; PAPER 2; INVERSE
1;" MIND THE VAMPIRES ": GO TO 5
80
2030 REM WINDOW
2050 LET A$="▄▄▄▄    "
2060 LET B$="█  █    "
2070 FOR N=0 TO 7: FOR M=0 TO 7:
 PRINT AT N,M; PAPER 6;" "
2080 NEXT M: NEXT N: FOR N=0 TO
3: PRINT AT N,0; PAPER 6;B$: NEX
T N: FOR N=0 TO 3 STEP 3: PRINT
AT N,0; PAPER 6;A$: NEXT N
2090 RETURN
2200 REM ***MOTH***
2210 RESTORE 2210: DATA 0,36,102
,255,126,102,36,36
2220 REM >>>BAT<<<
2230 DATA 8,28,62,63,127,231,195
,128,36,60,60,24,255,255,255,126
,16,56,124,252,254,231,195,1
2240 REM ###FORM GRAPHICS###
2250 FOR N=0 TO 3: FOR M=0 TO 7:
 READ A: POKE USR CHR$ (N+CODE "
A")+M,A: NEXT M: NEXT N
2300 FOR N=0 TO 21 STEP 2: FOR M
=1 TO 31 STEP 4: PRINT AT N,M; I
NK 1+INT (RND*3);"BCD": NEXT M:
NEXT N
2400 GO SUB 3400
2500 PRINT AT 6,0;K$
2600 PRINT AT 14,2; PAPER 6;" PR
ESS ""ENTER"" TO CONTINUE ";AT 2
1,10; PAPER 7; INK 0; FLASH 1;"
STOP THE TAPE ": PAUSE 0: CLS
2700 PRINT AT 2,10; PAPER 2; INK
 7; BRIGHT 1; FLASH 1;" B A T S
"
2800 PRINT AT 4,0;" YOU ARE A BA
T HUNTING MOTHS    "'"FOR SUPPER
."
2900 PRINT AT 6,0;" THE BAT IS M
OVED WITH KEYS No. "'" ""5 TO 8"
" "
3000 PRINT AT 8,0;" THE MOTH IS
CAUGHT WHEN THE "'"BAT IS CENTRA
LLY OVER IT"
3010 PRINT AT 10,0;" THE MOTH IS
 SAFE IN THE YELLOW "'"AREA OF T
HE LIGHTED WINDOW"'" THE BAT CAN
NOT GO HERE"
3020 PRINT AT 16,0;" THE GAME EN
DS WITH 10 MOTHS"'" ""HOME"" OR
""CAUGHT"""
3030 PRINT AT 18,0;" PRESS ""ENT
ER"" TO CONTINUE ": PAUSE 0: CLS
 : RETURN
3400 LET K$="
```



```
3410 RETURN
```

MAIL ORDER PROTECTION SCHEME

If you order goods from Mail Order Advertisers in this magazine and pay by post in advance of delivery, this publication will consider you for compensation if the advertiser should become insolvent or bankrupt, provided:

1. You have not received the goods or had your money returned; and
2. You write to the publisher of this publication explaining the position not earlier than 28 days from the day you sent your order and not later than 2 months from that day.

Please do not wait until the last moment to inform us. When you write, we will tell you how to make your claim and what evidence of payment is required.

We guarantee to meet claims from readers made in accordance with the above procedure as soon as possible after the advertiser has been declared bankrupt or insolvent to a limit of £1,800 per annum for any one advertiser, so affected, and up to £5,400 p.a. in respect of all insolvent advertisers. Claims may be paid for higher amounts, or when the above procedures have not been complied with, at the discretion of this publication, but we do not guarantee to do so in view of the need to set some limit to this commitment and to learn quickly of reader's difficulties.

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CLASSIFIED ADVERTISEMENTS ARE EXCLUDED.

Air raiders

More overhead excitement in this Spectrum program, courtesy of Mr HT Davis of Hereford.



This program differs a little bit from the normal 'war time' simulation games in that the shells actually follow a parabolic trajectory. The equation used to work out their motion is calculated in line 75 and simulates a projectile under gravity.

What goes up . . .

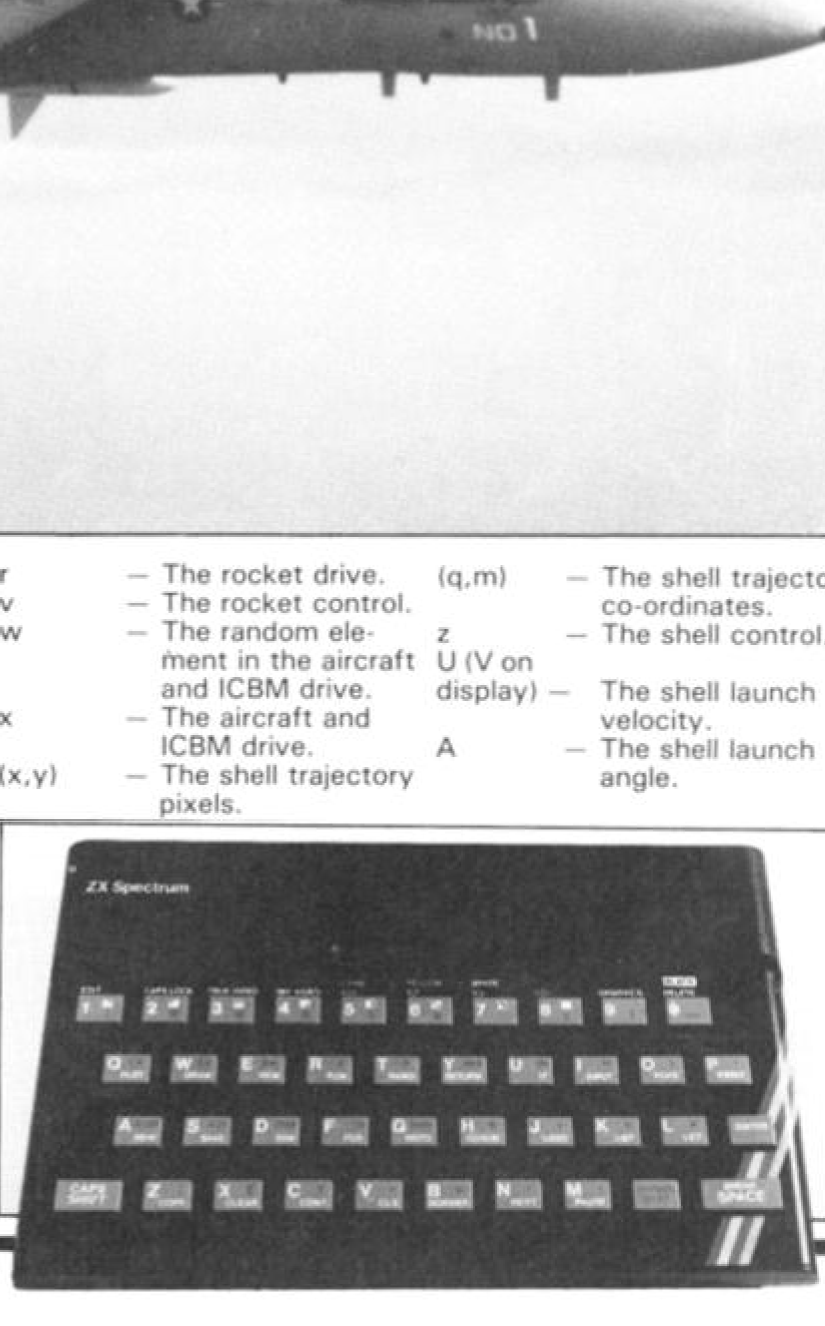
The initial velocity and angle of projection can either be selected by the player (mode x) or by the computer (mode z). The aim of the game is to destroy the overhead aircraft, launched ICBMs and the ICBM base; the ICBMs and their base must be destroyed using shells and the aircraft should be destroyed using rockets. The game stops either after eight cycles or if you accidently destroy an allied aircraft (you can spot them because they're blue!).

Full instructions are included in the program, including when one can fire a shell or a rocket. The program occupies virtually all of the 16K memory.

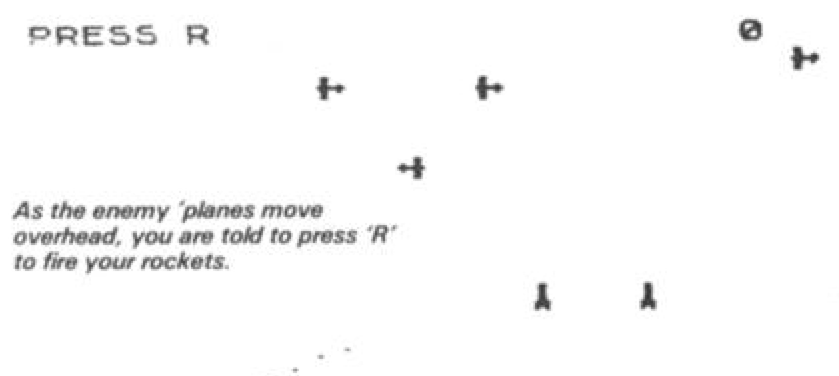
A variable situation

The variables used in this program are:

- g — The number of game cycles.
- p — The game mode.
- s — The score.
- r — The rocket drive.
- v — The rocket control.
- w — The random element in the aircraft and ICBM drive.
- x — The aircraft and ICBM drive.
- (x,y) — The shell trajectory pixels.
- (q,m) — The shell trajectory co-ordinates.
- z — The shell control.
- U (V on display) — The shell launch velocity.
- A — The shell launch angle.



```
   1 GO SUB 1000
   5 PAPER 6: INK 1
  10 DIM i$(704): PRINT AT 0,0;i
$
  12 BORDER 4
  14 PRINT INK 2; FLASH 1;AT 1,1
1;" AIR-RAID ": PRINT AT 4,2;"De
stroy the ICBM's and their     b
ase with shells (Key S)";AT 8,2;
"Destroy enemy aircraft with
 shells (S) and rockets (R)";AT
12,2;"Allied aircraft are blue a
nd    must not be hit"
  15 PAUSE 200: BORDER 5
  18 PRINT INK 2;AT 16,6;"To sel
ect own shell          traject
ory, press (X)";AT 20,2;"For ran
dom launch, press (Z)"
  19 PAUSE 200
  20 LET s=0
  25 LET g=0
  30 IF INKEY$="x" THEN LET p=1:
 GO TO 600
  32 IF INKEY$="z" THEN LET p=0:
 GO TO 725
  34 GO TO 12
  40 LET v=0
  45 LET z=0
  50 LET w=INT (RND*7)
  60 FOR x=0 TO 60
  61 IF x<40 AND z=0 AND v=0 THE
N PRINT INK 0; PAPER 7; FLASH 1;
AT 0,1;"FIRE S";AT 0,8;"V=";AT 0
,13;" ";AT 0,14;"A=";AT 0,10;U;"
 ";AT 0,16;A;" "
  70 IF z=0 THEN LET y=0
  75 IF z>.5 AND x-z<32 THEN LET
 y=((x-z)/3)*TAN (A*PI/180)-(55*
(x-z)*(x-z))/(U*U*COS (A*PI/180)
*COS (A*PI/180))
  76 IF x-z>1 AND y<=.025 THEN G
O SUB 500
  78 IF y<=4 AND x-z<32 AND z>=1
 THEN PLOT 8*(x-z),40*y
  80 LET r=22-2*x+2*v
  85 IF v<>0 AND x-v<12 THEN PRI
NT INK 0;AT r,5;"B";AT r,3;"B":
REM GRAPHICS B
  86 IF v<>0 AND x-v>1 AND x-v<1
3 THEN PRINT AT r+2,5;" ";AT r+2
,3;" "
  90 IF x<31 THEN PRINT INK 1;AT
 2,31-x;"A": REM GRAPHICS A
  91 IF x>0 AND x<32 THEN PRINT
AT 2,32-x;" "
 100 IF 2*w+x<52 AND 2*w+x>20 TH
EN PRINT ; INK 4;AT 1,51-2*w-x;"
A"
 101 IF 2*w+x<53 AND 2*w+x>21 TH
EN PRINT AT 1,52-2*w-x;" "
```



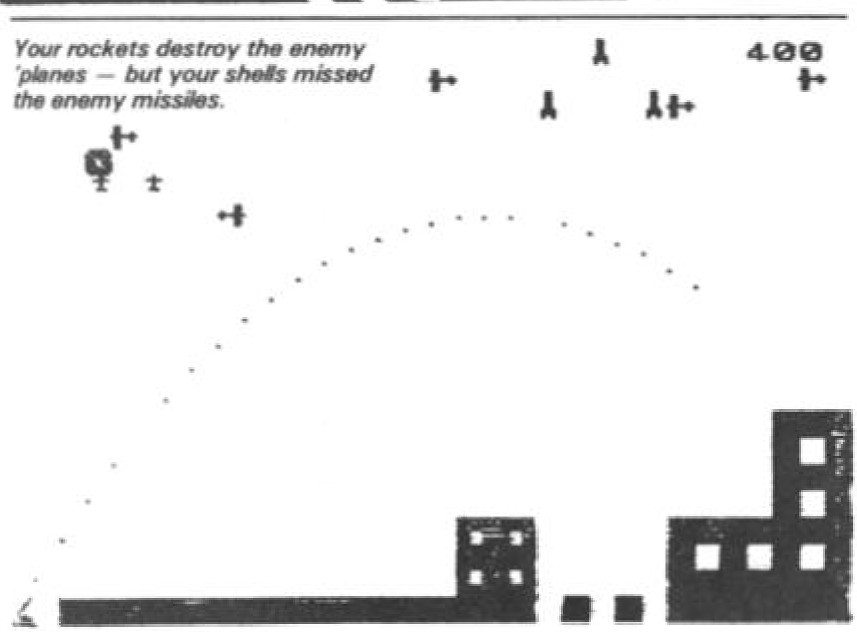
As the enemy 'planes move overhead, you are told to press 'R' to fire your rockets.

```
 102 IF x-5*w>0 AND x-5*w<33 THE
N PRINT INK 1;AT 2,32+5*w-x;"A"
 103 IF x-5*w>1 AND x-5*w<34 THE
N PRINT AT 2,33+5*w-x;" "
 105 IF x-5*w>=0 AND x-5*w<31 TH
EN PRINT INK 2;AT 5,x-5*w+1;"E":
REM GRAPHICS E
 106 IF x-5*w>0 AND x-5*w<32 THE
N PRINT AT 5,x-5*w;" "
 108 IF w+x>30 AND w+x<62 THEN P
RINT INK 2;AT 1,61-(w+x);"A"
 109 IF w+x>31 AND w+x<=62 THEN
PRINT AT 1,62-(w+x);" "
 110 IF x>24 AND x<56 THEN PRINT
 INK 3;AT 3,x-24;"E"
 111 IF x>25 AND x<57 THEN PRINT
 AT 3,x-25;" "
 113 IF x>29 THEN PRINT INK 4;AT
 5,x-29;"E"
 114 IF x>30 THEN PRINT AT 5,x-3
0;" "
 120 IF x>8 AND x<=29 THEN PRINT
 INK 3;AT 29-x,24;"C";AT 29-x,20
;"C": REM GRAPHICS C
 121 IF x>8 AND x<=30 THEN PRINT
 AT 30-x,24;" ";AT 30-x,20;" "
 124 IF 2*w+x>14 AND 2*w+x<=35 T
HEN PRINT INK 3;AT 35-(2*w+x),22
;"C"
 125 IF 2*w+x>14 AND 2*w+x<=36 T
HEN PRINT AT 36-(2*w+x),22;" "
 128 IF x>38 AND x<=59 THEN PRIN
T INK 5;AT 59-x,24;"C";AT 59-x,2
0;"C"
 129 IF x>38 AND x<61 THEN PRINT
 AT 60-x,24;" ";AT 60-x,20;" "
 132 IF w+x>37 AND w+x<59 THEN P
RINT INK 4;AT 58-(w+x),22;"C"
 133 IF w+x>37 AND w+x<60 THEN P
RINT AT 59-(w+x),22;" "
 150 LET q=INT ((175-40*y)/8): L
ET m=x-z
 155 IF ATTR (q,m)=57 AND m<32 A
ND z>.5 AND q>0 THEN PRINT AT q,
m;"G": GO TO 850: REM GRAPHICS G
 156 IF ATTR (q,m)>57 AND m<32 A
ND z>.5 AND q>0 THEN PRINT AT q,
m;"G": BEEP 1,-25: LET s=s+200
 160 IF SCREEN$ (q,m)="'" AND m<
32 AND z>.5 THEN PRINT AT q,m;"
": BEEP .2,-10: LET s=s+50
 170 IF ATTR (r,3)=57 AND v<>0 A
ND x-v<12 THEN PRINT INK 6;AT r,
3;"G": BEEP 1,-20: GO TO 850
 171 IF ATTR (r,5)=57 AND v<>0 A
ND x-v<12 THEN PRINT INK 6;AT r,
5;"G": BEEP 1,-20: GO TO 850
 173 IF ATTR (r-1,3)>57 AND v<>0
 AND x-v<11 THEN PRINT INK 6;AT
r-1,3;"G": BEEP 1,-20: LET s=s+1
00
 174 IF ATTR (r-1,5)>57 AND v<>0
 AND x-v<11 THEN PRINT INK 6;AT
r-1,5;"G": BEEP 1,-20: LET s=s+1
00
 180 PRINT INK 0; FLASH 1;AT 0,2
8;s;" "
 200 IF x<40 AND INKEY$="s" THEN
 GO SUB 300
 205 IF INKEY$="r" THEN GO SUB 4
00
 215 IF x>=40 AND v=0 THEN GO SU
B 303
 220 IF v=0 AND z>.5 THEN GO SUB
 305
 230 IF x-v>11 AND z>0 THEN GO S
UB 305
 235 IF x-v>11 AND z=0 THEN GO S
UB 550
 240 NEXT x
 245 DIM i$(25): PRINT AT 0,0;i$
 250 DIM i$(445): PRINT AT 1,0;i
$
 255 DIM i$(29): PRINT AT 14,0;i
```

```
$: PRINT AT 15,0;i$: PRINT AT 16
,0;i$: PRINT AT 17,0;i$
 260 DIM i$(17): PRINT AT 18,0;i
$: PRINT AT 19,0;i$
 261 DIM i$(16): PRINT AT 20,1;i
$
 263 LET g=g+1: IF g=8 THEN GO T
O 900
 265 IF p=1 THEN GO TO 605
 268 IF p=0 THEN GO TO 725
 270 GO TO 40
 300 LET z=x
 303 IF INKEY$="r" THEN GO TO 40
2
 306 IF v=0 OR x-v>9 THEN PRINT
INK 0; FLASH 1; PAPER 6;AT 0,0;"
PRESS R ": PRINT PAPER 7;AT 0,9
;"        "
 310 RETURN
 400 IF z<.5 THEN GO TO 450
 402 IF v=0 AND x-z>4 THEN LET v
=x
 405 IF x-v>11 THEN LET v=x
 445 IF x=v THEN PRINT PAPER 7;A
T 0,0;"                        "
 450 RETURN
 500 IF z<>0 THEN LET z=.5
 505 RETURN
 550 IF v<>0 THEN GO TO 305
 555 RETURN
 600 CLS
 603 IF g=0 THEN GO TO 780
 605 INPUT "Enter Speed U",U
 610 INPUT "Enter Angle A",A
 615 GO TO 40
 725 LET U=80+INT (RND*40)
 730 LET A=25+INT (RND*40)
 740 IF g<>0 THEN GO TO 40
 780 CLS
 790 BORDER 5: INK 0: PAPER 7
 795 DIM i$(704): PRINT AT 0,0;i
$
 800 PRINT INK 2;
   AT 14,29;"  ▐█▌";
   AT 15,29;"  ▐█▌";
   AT 16,29;"  ▐█▌";
   AT 17,29;"  ▐█▌";
   AT 18,17;"██      ███";
   AT 19,17;"██      ███";
   AT 20,17;"██      ███";
 805 PRINT OVER 1; INK 2;
   AT 14,29;"   ";
   AT 15,29;"   ";
   AT 16,29;"   ";
   AT 17,29;"   ";
   AT 18,17;"            ";
   AT 19,17;"            ";
   AT 20,17;"            ";
 810 PRINT INK 4;AT 21,2;"███ ██
████████ █ █ ████████": PRINT
INK 0;AT 21,3;"█";AT 21,5;"█"
 815 PRINT OVER 1; INK 4;AT 21,2
1;"'";AT 21,23;"'"
 830 PRINT AT 21,0;"H": REM GRAP
HICS H
 840 IF p=1 THEN GO TO 605
 845 IF p=0 THEN GO TO 40
 850 CLS
 854 INK 1
 860 PRINT FLASH 1;AT 5,11;"GAME
OVER": PRINT AT 8,4;"You have d
estroyed one";AT 10,6;"of your o
wn planes";AT 13,6;"Your score :
5 "; FLASH 1; INK 0; PAPER 7;s;"
"
 865 PRINT AT 16,4;"Press <P> to
play again"
 870 FOR d=0 TO 7
 874 IF INT (d/2)=d/2 THEN BEEP
.5,2
 876 IF INT (d/2)<>d/2 THEN BEEP
.5,-2
 880 IF INKEY$="p" THEN GO TO 5
 885 NEXT d
 890 GO TO 860
 900 CLS
 910 INK 1
 920 PRINT FLASH 1;AT 3,11;"GAME
OVER": PRINT AT 8,6;"You have s
cored "; FLASH 1; INK 1; PAPER 7
;s;""
```



```
 925 PRINT AT 11,4;"without loss
of aircraft";AT 16,5;"Press <P>
to play again"
 930 FOR e=10 TO 70 STEP 10
 935 BORDER e/10
 940 IF SIN (2*e/PI)<.4 THEN BEE
P .5,10
 945 IF SIN (2*e/PI)>=.4 THEN BE
EP .6,-20
 950 IF INKEY$="p" THEN GO TO 5
 955 NEXT e
 960 GO TO 920
1000 DATA 0,96,96,98,255,98,96,9
6
1010 DATA 8,62,8,8,28,0,0,0
1020 DATA 24,24,24,24,24,60,60,3
6
1030 DATA 0,6,6,70,255,70,6,6
1040 DATA 126,189,219,231,231,21
9,189,126
1050 DATA 2,4,8,16,32,40,30,255
1100 LET u=PEEK 23675+256*PEEK 2
3676
1110 FOR i=0 TO 7: READ j: POKE
u+i,j: NEXT i
1120 FOR i=0 TO 7: READ j: POKE
u+8+i,j: NEXT i
1130 FOR i=0 TO 7: READ j: POKE
u+16+i,j: NEXT i
1140 FOR i=0 TO 7: READ j: POKE
u+32+i,j: NEXT i
1150 FOR i=0 TO 7: READ j: POKE
u+48+i,j: NEXT i
1160 FOR i=0 TO 7: READ j: POKE
u+56+i,j: NEXT i
1200 RETURN
```



Your rockets destroy the enemy 'planes — but your shells missed the enemy missiles.

Club corner



If you run, or are a member of, a user club which caters for the Sinclair user, why not get your group on the map by writing to us at:

Club Corner,
ZX Computing,
145 Charing Cross Road,
London WC2H 0EE.

All you have to do is to send us a letter with details of your club (times of meetings, addresses of who to contact, etc) and we'll do the rest. If you publish a newsletter or club magazine, we'd very much like to see that too.

And if you don't see a club in your area, why not start one up by writing to *ZX Computing* and seeing if any like-minded enthusiasts wish to join you.

National ZX Users' Club

Dear ZX Computing,
I am writing to announce the closure of The National ZX Users' Club which was founded by Tim Hartnell over three years ago.

When Tim started Interface, there were no local user groups or specialist ZX oriented magazines. But there comes a point when one must grow up — when other people are doing the job you have been doing. Tim Hartnell and The National ZX Users' Club gave a lot of help to the magazine Sinclair User at its inception and as your readers are aware, Tim was Editor of *ZX Computing* for the first four issues.

Those with memberships still to run are being offered either a full refund for the outstanding period, or free books published by Interface Publications. On a further note, Interface Publications will continue to flourish in the field of computer-related books and Tim Hartnell will continue to write and edit new titles.

As you know, the membership of our club has been strong in the past, over 10,000 members at its peak, and I would like to take this opportunity to thank all of them for their support.
Yours faithfully,

Liz North,
Interface Publications.

Lambeth Computer Club

Dear ZX Computing
The Lambeth Computer Club has now been fully organised, even to the extent of a draft constitution. Our inaugural meeting was on Saturday, 30 April, with some 12 members attending (60% of the membership). Our first Annual General Meeting is planned for Thursday, 15 September, the venue to be announced.

Will new members please contact me at the address below. Your name and address will be passed as soon as possible to the Membership Secretary.
Yours faithfully,

Robert Baker,
54 Brixton Road,
London SW9 6BS.

Llantwit Major Computer Club

Dear ZX Computing
We have, after three meetings, already achieved a membership of some 20 people whose experience on personal computers range from elementary knowledge to quite advanced ability. Age range of members is also very varied.

The club meets every Tuesday evening in the Adult Education Centre in Llantwit Major where we have the facilities of the comprehensive school's computer equipment. Members are also encouraged to bring along their own computers.

The basic objectives of the club have been defined as follows:

a) To encourage greater computer programming skills.
b) To attain greater understanding of the internal operation of computers.
c) To develop the use of different programming languages.
d) To assess the market availability of both software and hardware.
e) To foster the advancement of personal knowledge of computers and equipment by association with other interested computer users.
f) To keep abreast of the state of the art.

We hope to supplement these objectives by holding occasional lectures by professional computer users and arranging visits to local establishments who are involved in the manufacture and use of computers.
Yours faithfully,

Douglas Mountain
16 Denbigh Drive,
Llantwit Major,
South Glamorgan,
CF6 9GQ.

Sutton Library Computer Club

Dear ZX Computing,
I am writing with fuller details of the club we formed earlier this year which might be of interest to your readers.

We meet on the first Friday of each month between 6.15 and 10pm and on the third Tuesday of each month between 8.15 and 10pm at the Sutton Central Library, St Nicholas Way, Sutton, Surrey.

Subscriptions are £6 for adults, and £4 for students and pensioners. Our membership is currently around 100.

New members are always welcome whether experienced or new to computers. No machine is necessary, and indeed about 25% of our membership do not own a computer.

We have a programme for 1983 which includes everything from an introduction for beginners to machine code and Prestel editing. In addition to the formal groups at each meeting, members are encouraged to bring their equipment along to demonstrate and exchange ideas and help solve each other's computing problems.

For further information contact me at the address below or 'phone Jennifer Woeller at the Sutton Library on 01-661 5031.
Your faithfully,

David Wilkins,
22 Chestnut Court,
Mulgrave Road,
Sutton,
Surrey SM2 6LR.

The Edinburgh Home Computing Club

Dear ZX Computing,
The Edinburgh Home Computing Club (formerly the Edinburgh ZX Users Club) meets three times a month at the Claremont Hotel, Edinburgh on the second, third and fourth Wednesday of each month. The club is open to all those interested in the uses of micros and we also produce a bimonthly newsletter with articles, software and hardware reviews of interest to the members.

Anyone interested should contact John Pamer on 031-661 3183 after 6pm, myself at the address below or just come along to one of the meetings.
Yours faithfully,

Ian Robertson,
Secretary,
71 Oxgangs Terrace,
Edinburgh EH13 9BZ.
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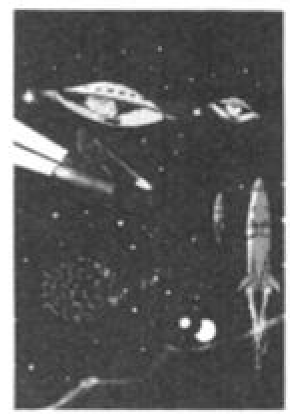
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Poor little Henry is the hen-pecked hero of this domestic tale. One night he can take no more. He steals his wages from his wife's purse, sneaks out of the house being careful not to wake the baby or trip over the cat, and heads for the bright lights to have some fun. Trouble is he runs out of money. His only way to raise some cash is to gamble his few remaining pounds on the spinning wheel of the roulette table. Just as Henry is getting into his evening his wife — Mad Martha — has noticed his absence. Realising Henry has absconded with the housekeeping she sets out after him with an axe. Guess what part you play in this happy tale? That's right, you're Henry. Watch out for that axe!

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Motor madness



Enter the Grand Prix in this program for your ZX81 written for us by Keith Ditchburn of Danby.

You are a racing driver in the Grand Prix and you must steer your car using the '5' and '8' keys to move left and right respectively.

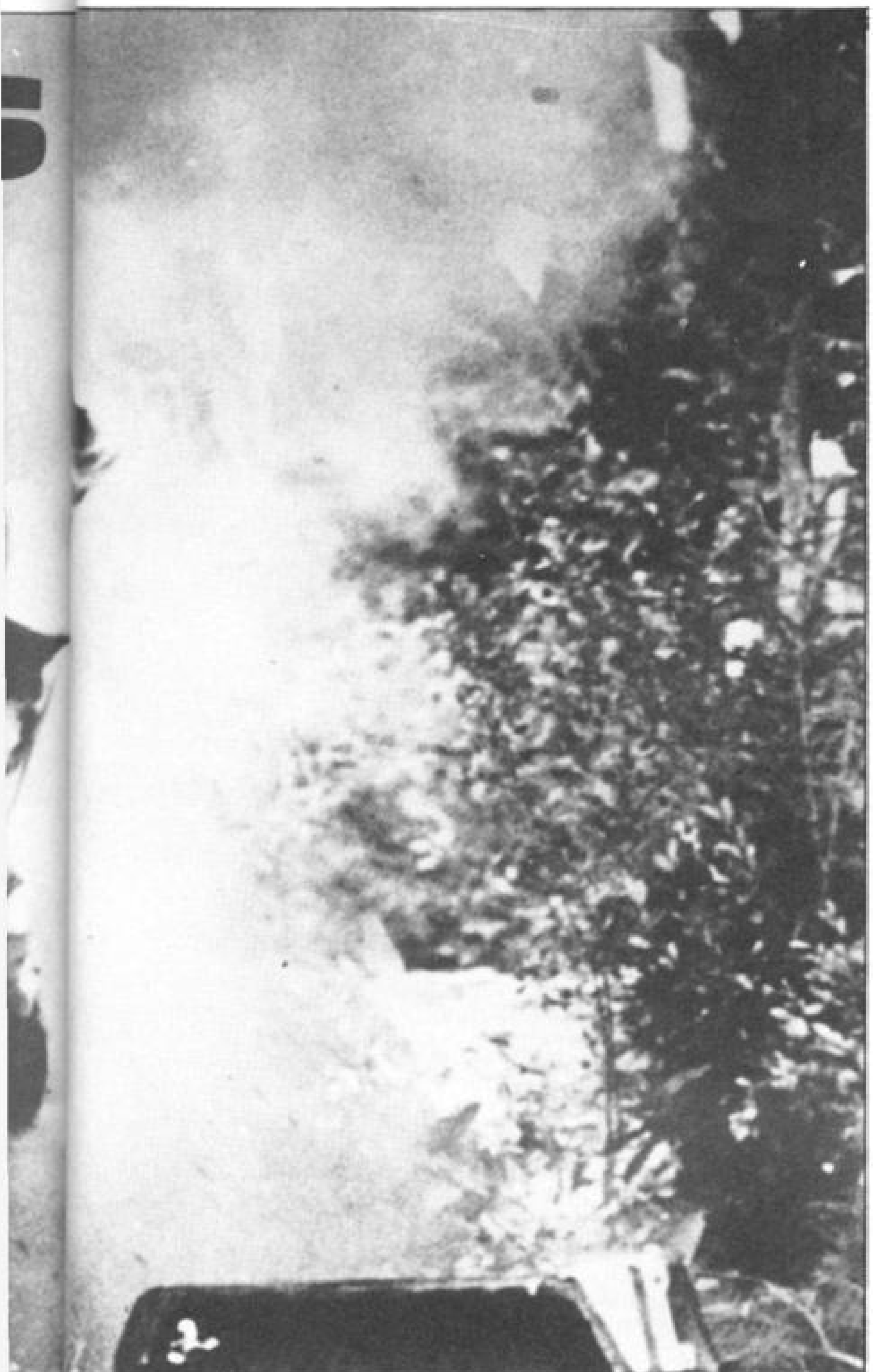
The machine code takes up to 50 bytes and should be located in a REM statement with the starting address 16514. The routine you'll need to POKE this into your computer follows below:

```
1  REM 50 Es
10 LET A = 16514
20 INPUT N
30 PRINT N;",";
35 POKE A,N
40 LET A = A + 1
50 GOTO 20
```

Once this program has been entered into the computer you should type in the following numbers. (The commas separating the numbers represent Newline.)

Okay, you're on your own now – happy racing, and try and keep out of the fast lane!

```
42, 12, 64, 229, 17, 33, 0, 25, 209, 1, 214, 2, 237,
176, 42, 12, 64, 35, 6, 15, 35, 5, 194, 150, 64, 14,
126, 6, 16, 17, 33, 0, 25, 5, 194, 162, 64, 6, 5, 5, 35,
113, 194, 169, 64, 201,
```



```
   1 REM E£RND FAST )5 ;SGN ▀CHR
$ ▀ GOSUB ▓E£RND7▞ 7▌TAB ▛RND:▙▘
()5 ;▌TAB ▛RND▞▀▜ 7?TAB ▛RNDTAN T
AN EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEE
   2 DIM A$(12,10)
   3 DIM A(12)
   4 GOSUB 6000
   9 LET SC=0
  10 FOR F=0 TO 21
  20 PRINT "▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓
▓▓"
  30 NEXT F
  80 LET W=PEEK 16396+256*PEEK 1
6397
  85 LET C=W+8+(33*5)
  90 POKE 16552,10
 100 LET E=INT (RND*7)+3
 102 LET EC=W+E+4+(33*16)
 103 IF E>=8 THEN POKE EC,CODE "
▣"
 105 IF E=6 THEN POKE 16540,CODE
"▒"
 110 POKE 16533,E
 115 LET SC=SC+1
 120 LET L=USR 16514
 126 POKE 16540,CODE "■"
 130 POKE C,CODE "*"
 140 LET C=C+(INKEY$="8")-(INKEY
$="5")
 150 IF PEEK (C+33)<>CODE "■" TH
EN GOTO 400
 160 POKE C-33,CODE "■"
 170 GOTO 100
 400 IF PEEK (C+33)=CODE " " OR
PEEK (C+33)=CODE "▣" THEN GOTO 5
00
 405 IF PEEK (C+33)=CODE "▒" THE
N LET C=C+2
 410 GOTO 100
 500 POKE C,CODE " "
 510 FOR F=1 TO 4
 520 POKE C-F,CODE "."
 530 POKE C+F,CODE "."
 540 NEXT F
 550 FOR F=1 TO 4
 560 POKE C-F,CODE ":"
 570 POKE C+F,CODE ":"
 580 NEXT F
 590 FOR F=1 TO 4
 600 POKE C-F,CODE " "
 610 POKE C+F,CODE " "
 620 FOR U=1 TO 8
 630 NEXT U
 640 NEXT F
 650 PRINT AT 3,5;"AAAAAAAAGH"
 660 FOR F=1 TO 60
 670 NEXT F
 680 CLS
 690 PRINT "SCORE=";SC
 695 IF SC<=A(2) THEN GOTO 915
 697 PRINT AT 10,0;"YOU HAVE OBT
AINED A SCORE IN THE TOP TEN"
 698 PRINT AT 20,0;"PLEASE INPUT
 YOUR NAME"
 700 INPUT A$(2)
 710 LET A(2)=SC
 720 LET K=0
 730 FOR I=1 TO 11
 740 IF A(I)>A(I+1) THEN GOTO 76
0
 750 GOTO 900
 760 LET T=A(I)
 770 LET D$=A$(I)
 780 LET A(I)=A(I+1)
 790 LET A$(I)=A$(I+1)
 800 LET A(I+1)=T
 810 LET A$(I+1)=D$
 850 LET K=K+1
 900 NEXT I
 910 IF K<>0 THEN GOTO 720
 915 CLS
 920 FOR F=12 TO 2 STEP -1
 930 PRINT A$(F);" ";A(F)
 940 NEXT F
 950 IF INKEY$="" THEN GOTO 950
 960 CLS
 970 GOTO 5
5999 STOP
6000 FOR F=1 TO 12
6010 LET A$(F)="??????"
6020 LET A(F)=0
6030 NEXT F
6040 PRINT " INSTRUCTIONS "
6050 PRINT "YOU ARE A RACEING DR
IVE AND"
6060 PRINT "YOU HAVE TO AVOID TH
E CARS(▣)"
6070 PRINT "OCCASIONALY THERE WI
LL BE ICE ON"
6080 PRINT "THE ROAD (▒) AND YOU
 WILL TEND"
9090 PRINT "TO SKID ON IT SO BEW
ARE"
9100 PRINT
9120 PRINT "PRESS A KEY TO START
"
9130 IF INKEY$="" THEN GOTO 9130
9140 CLS
9150 RETURN
```

Spectrum streams

Mike Lord, author of Exploring Spectrum BASIC, shows you how to make use of some of the more inaccessible commands on the Spectrum.

Most of the software needed to handle the promised Spectrum RS232 Network and Microdrive will be in a ROM in the new interface. But, the BASIC ROM in the Spectrum itself does contain some undocumented functions which — although intended for use with the new peripherals — can be used without them. They control the way input to a program, and output from it, are handled.

BASICally speaking

Within a BASIC program, the Spectrum manual says that we can use:

PRINT to output to the upper part of the TV screen.
LPRINT to output to the ZX Printer.
INPUT to output to the lower part of the TV screen, and also to input from the keyboard.

But experimentation has shown that there is another form of these commands:

```
PRINT # n;
LPRINT # n;
INPUT # n;
```

where 'n' is any valid numeric expression.

Normally, giving 'n' any value other than 0, 1, 2 or 3 will result in the error message:

INVALID STREAM

So, it seems logical to call 'n' the 'Stream number'. The four valid values give the following results:

0/1 These values are the same; they cause output to be printed on the lower half of the screen, whether PRINT, LPRINT or INPUT is used, and they allow input from the keyboard with an INPUT statement.

2 This value causes output to the upper part of the screen, regardless of whether the keyword used is PRINT, LPRINT or INPUT. But, any attempt to input a value, as for example with:

```
INPUT #2;"Enter a number ";A
```

will result in the error message:

INVALID I/O DEVICE

3 This value is similar to 2, except that output is to the ZX Printer rather than to the screen.

One use for these 'Stream numbers' is to give the user of a program the choice of output to the screen or to the printer:

```
100 INPUT "Enter 2 for display, 3 for hard copy ";strm
. . . .
200 PRINT #strm;"Message 1"
. . . .
300 PRINT #strm;"Message 2"
```

More deviously, we can use PRINT #0; or PRINT #1; to display a message on the bottom part of the screen, in the same way that INPUT normally does but without expecting an input from the user. For example:

```
PRINT #0;" 24th line" : PAUSE 0
```

The PAUSE 0 statement here is to prevent the message being over-written by the Spectrum's OK report when it has finished executing the PRINT command in this little demonstration.

Having got a message onto the bottom line of the screen, it can be deleted by an INPUT statement, which always clears the lower part of the display. And, if you don't actually want to INPUT anything at that stage in the program, then you can just use the strange looking command:

```
INPUT ""
```

which clears the bottom of the screen, prints nothing, then moves immediately on to the next statement in your program. To see this, try:

```
10 FOR A=1 TO 10
20 PRINT #0;A
30 PAUSE 25
40 INPUT ""
50 NEXT A
```

One variant which can often be useful is:

```
PRINT #0;"Press any key to continue" : PAUSE 0 : INPUT ""
```

If you don't clear the bottom part of the screen, then subsequent PRINT #0 statements will print on successive lines, scrolling the bottom part of the screen up to make room, as can be seen from:

```
10 FOR A=0 TO 21 : PRINT A : NEXT A
20 FOR A=1 TO 20 : PRINT #0;A : NEXT A
```

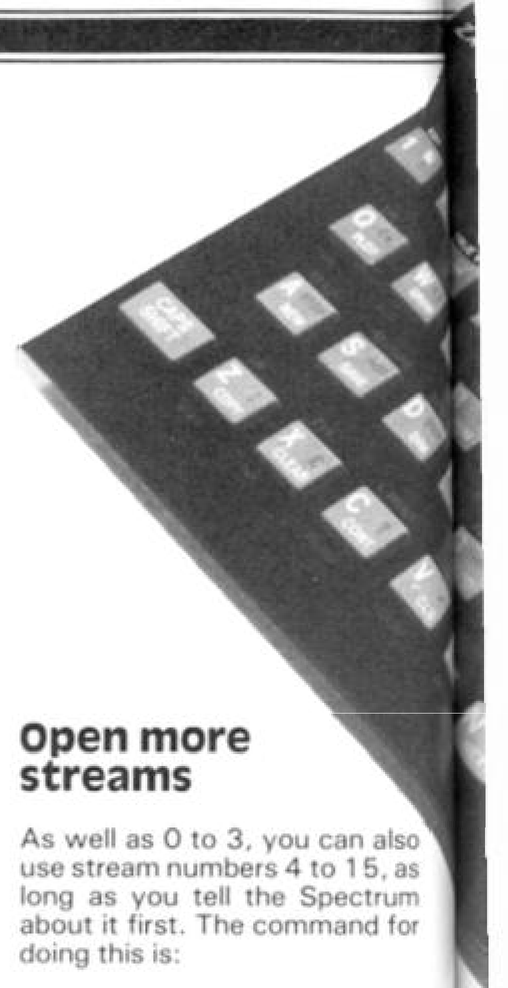
But you can overcome this by including an AT function in the PRINT #0 command:

```
10 FOR A=1 TO 100
20 PRINT #0; AT 0,0;A
30 NEXT A
```

If you try this you will see that it prints on the 23rd line which is, of course, normally the top line of the lower part of the display. Changing line 20 to:

```
20 PRINT #0; AT 1,0;A
```

and this will make it print on the 24th line. If the AT line number is greater than one, then the bottom part of the screen will be expanded, scrolling the top part up to make room.



Open more streams

As well as 0 to 3, you can also use stream numbers 4 to 15, as long as you tell the Spectrum about it first. The command for doing this is:

```
OPEN #n , c$
```

where 'n' is the stream number (4-15) and 'c$' is:

"P" For output to the ZX Printer.
"S" For output to the upper part of the screen.
"K" For output to the lower part of the screen and input from the keyboard.

(OPEN # is below key 4.) So, if you include:

```
OPEN #15,"P"
```

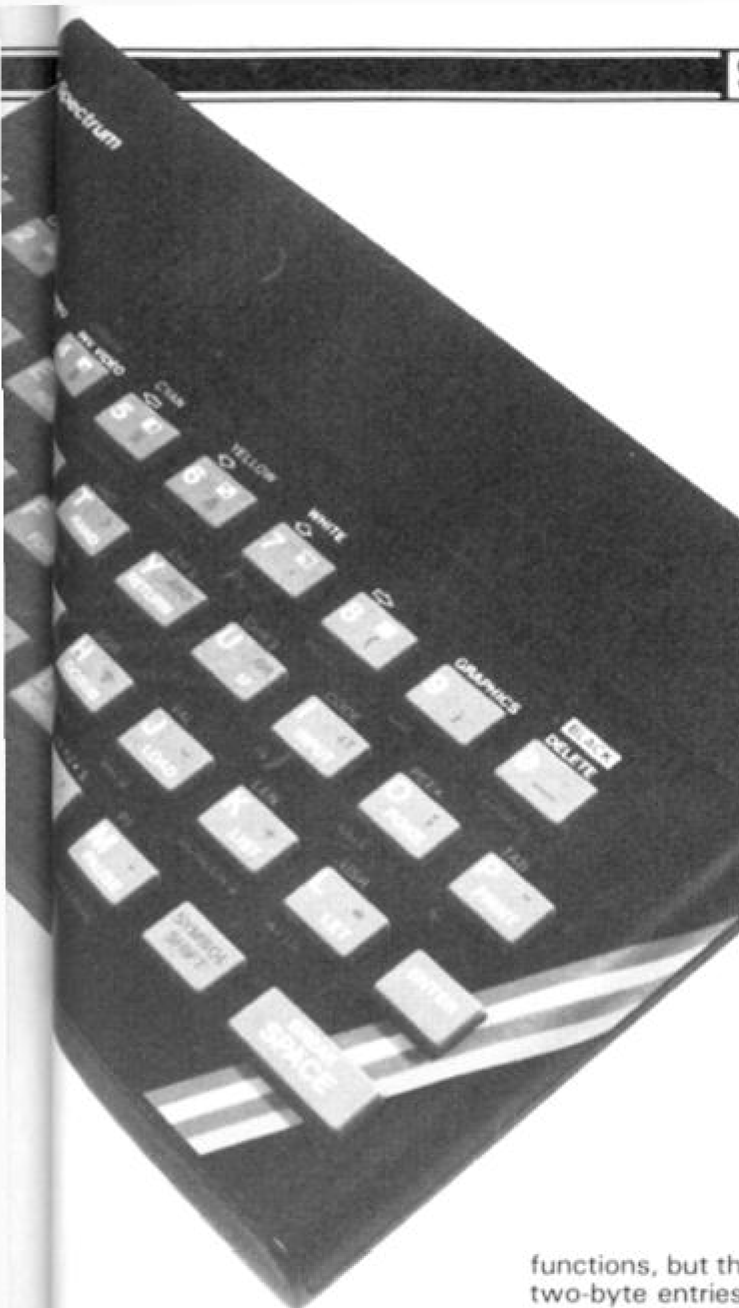
in a program, then any subsequent PRINT #15 (or LPRINT #15 or INPUT #15) statements will output to the printer.

The CLOSE #n command (see below key 5) does the opposite — cancelling any OPEN #n streams — although it can't be used to close the four predefined streams numbered 0 to 3.

Presumably the extra ROM software provided with the RS232/Net/Microdrive interface will let you use the OPEN # command to set up channels for communicating with the I/O devices and with Microdrive files — we shall have to wait and see!

In machine code

Things get even more interesting when you look at how the Spectrum handles the '#' commands. The Spectrum manual gives a few clues about how they work. Within the



system variables area there is a block of 38 bytes (23568-23605) called 'STRMS' which contains the 'Addresses of channels attached to streams'. Then at 23631/2 the system variable CHANS is said to hold the 'Address of Channel Data', and this is followed at locations 23633/4 by CH.RCHL, the 'Address of information currently being 'Address of Channel Data', and this is followed at locations 23633/4 by CHURCHL, the 'Address of information currently being used for input and output'. Also, the memory map in chapter 24 of the manual shows an area denoted as 'Channel Information'. CHANS holds the address of the start of this area; the end is signalled by a byte of value 80 Hex.

After some investigations into the contents of these RAM locations and into the workings of the Spectrum ROM, the following picture emerged.

The 38 bytes of STRMS consist of 19 two-byte entries. On power-up or after a NEW command, they are set to the values shown in Table 1. The first three entries are used for other ROM functions, but the remaining 16 two-byte entries correspond to stream numbers 0 to 15. The OPEN # and CLOSE # statements mentioned earlier change the values in this table. For example, OPEN #4,"S" changes the contents of location 23582 to 6.

These values turn out to be pointers, so that the value in system variable CHANS plus the value from the STRMS table minus one, gives the address of one of the entries in the Channel Information area of RAM. Each entry in this area is five bytes long, and consists of two two-byte addresses followed by a single byte containing the code for one of the characters, "K", "S", "R" or "P". (Note that "K", "S" and "P" are the letters allowed in an OPEN # statement.)

Without the RS232/Net/Microdrive interface fitted, the Channel Information area is 21 bytes long, and contains four blocks as shown in Table 2. The first address in each block is the starting address of a ROM routine used to output a character. The second address is either that of a ROM routine to input a character from the keyboard or of a routine which gives the 'INVALID I/O DEVICE' error message.

In comparison

By comparing Tables 1 and 2, we see that the first pair of addresses in the Channel Information area are used by streams '0' and '1', the third pair by '2' and the fourth pair by '3'.

In each case, the Spectrum looks up the address of the appropriate I/O routine in the table then calls it with the character to be output in the Z80's A register. What this means is that if, say, we wanted to drive a special, non-ZX, printer, then we could write a machine code routine to handle it, and replace the first two bytes of the fourth block in the Channel Information area by the starting address of the new routine. Any LPRINT, LLIST or PRINT #3 commands would then automatically use the new printer drive routine! If you are actually going to do this, then note that your machine code routine must be able to cope with the print control codes (6 to 23), the keyword codes (165 to 255) and graphics character codes, as well as with 'normal' characters.

You will see from Table 2 that the same ROM routine (starting at OF94 Hex) is used to print to either half of the display and also to the ZX Printer. The routine decides where to send the output by looking at bit one of FLAGS (23611) which is '0' for output to the screen and '1' for output to the printer, and also at bit zero of TVFLAG (23612) which is '0' when the output is to the top part of the screen and '1' for output to the lower part.

Via RST10

Machine code programmers will be used to using RST10 to output the character whose code is in the A register. What RST10 does, in fact, is to take the contents of the system variable, CHURCHL, which will be the address of one of the entries in the Channel Information table, and then jump to the address held at that entry. Again, FLAGS and TVFLAG determine where the output goes.

You can set these flags up by calling the ROM routine at 1601 Hex with the A register containing '0' for output to the lower part of the screen, '2' for the top part of the screen or '3' to select the ZX Printer.

Table 1 : The contents of STRMS.

Location	Contents	Stream
23568	1	—
23570	6	—
23572	11	—
23574	1	0
23576	1	1
23578	6	2
23580	16	3

All other locations from 23568 to 23605 contain zeros.

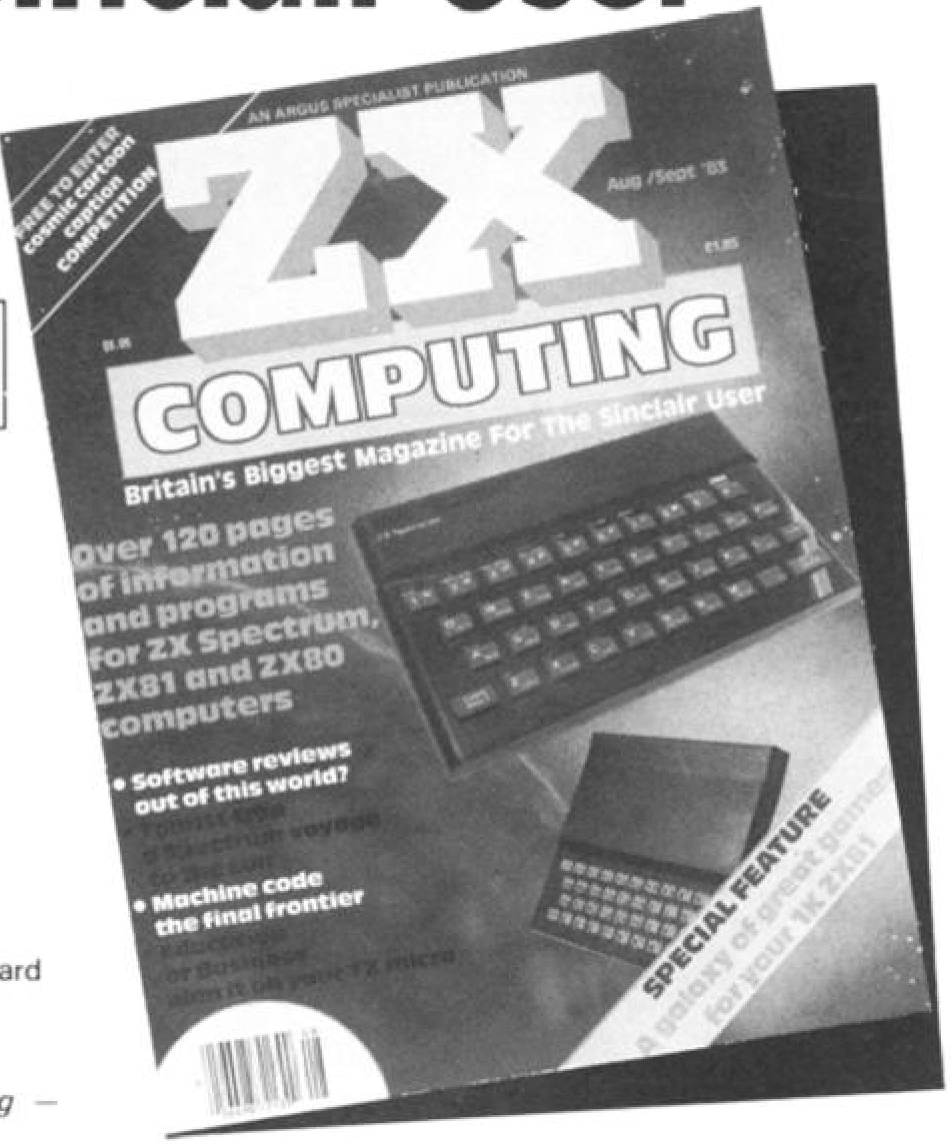
Table 2. The Channel Information area of RAM.

Contents of the 21 bytes, in Hex.

F4 09	Address of PRINT routine.
AB 10	Address of routine to get character from keyboard.
4B	Letter "K".
F4 09	Address of PRINT routine.
C4 15	Address of 'INVALID I/O DEV' error routine.
53	Letter "S".
81 OF	Address of routine to insert character into RAM.
C4 15	Address of 'INVALID I/O DEV' error routine.
52	Letter "R".
F4 09	Address of PRINT routine.
C4 15	Address of 'INVALID I/O DEV' error routine.
50	Letter "P".
80	End of Channel Information.

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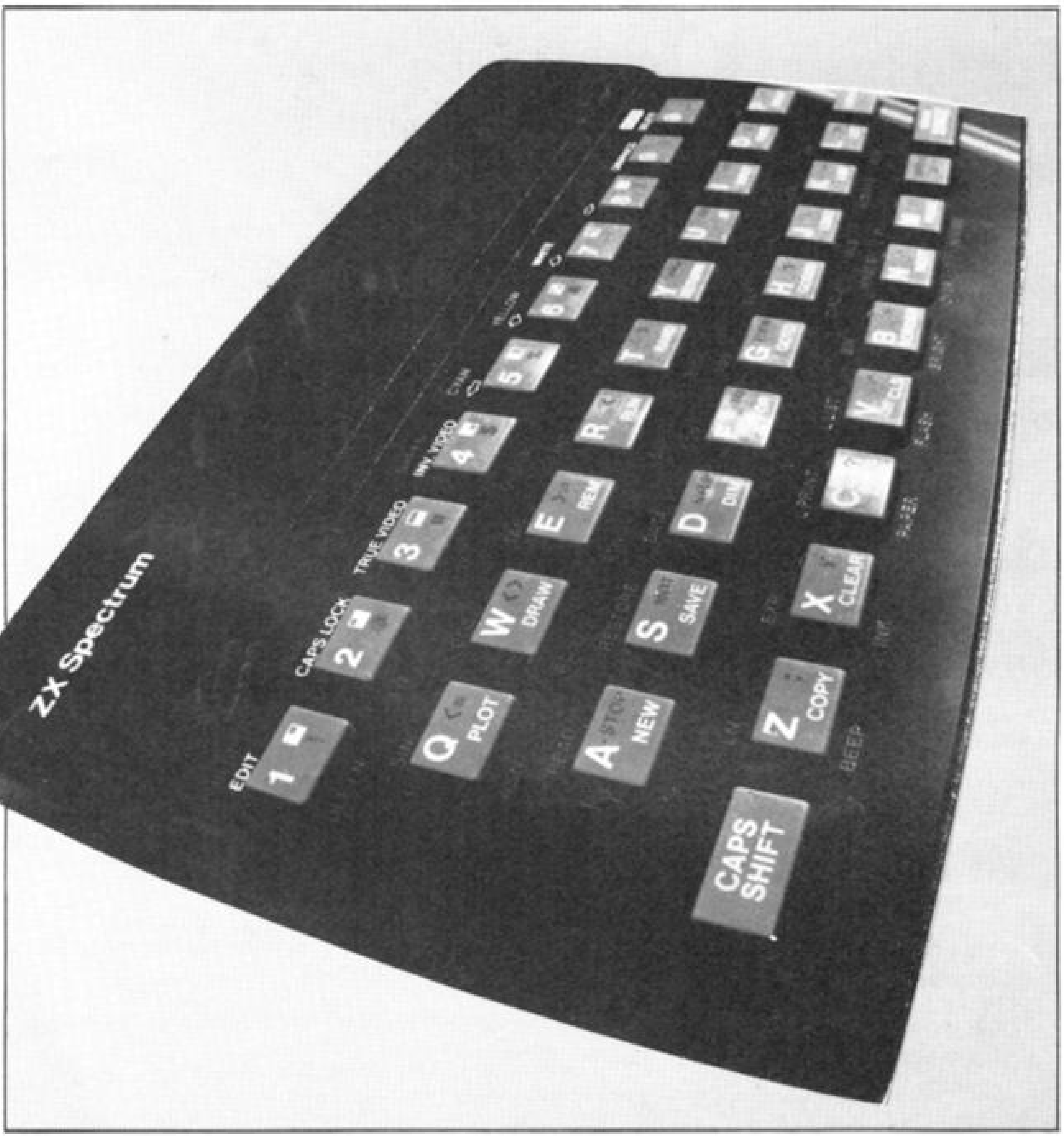
Morse trainer

Use your Spectrum to learn the Morse code with this program written for us by RJ Gilbert of Bathgate, West Lothian.

The program itself is a fairly straightforward listing being very user friendly and menu driven. In the test mode, the instructions for operation are displayed and a Morse character is BEEPed. It is then up to the user to INPUT a letter. Should you not provide the correct letter, you will be informed. You are given three opportunities to give the correct answer, after which the correct letter is displayed along with its relevant dots and dashes, and the letter is BEEPed in Morse code again.

A load of code

Mr Gilbert has used a number of useful POKEs in this program, some of which were suggested by Tim Hartnell in an article in the August/September issue of *ZX Computing*, page 120. However, for the benefit of those who did not manage to catch the article, here is a brief explanation of these POKEs:



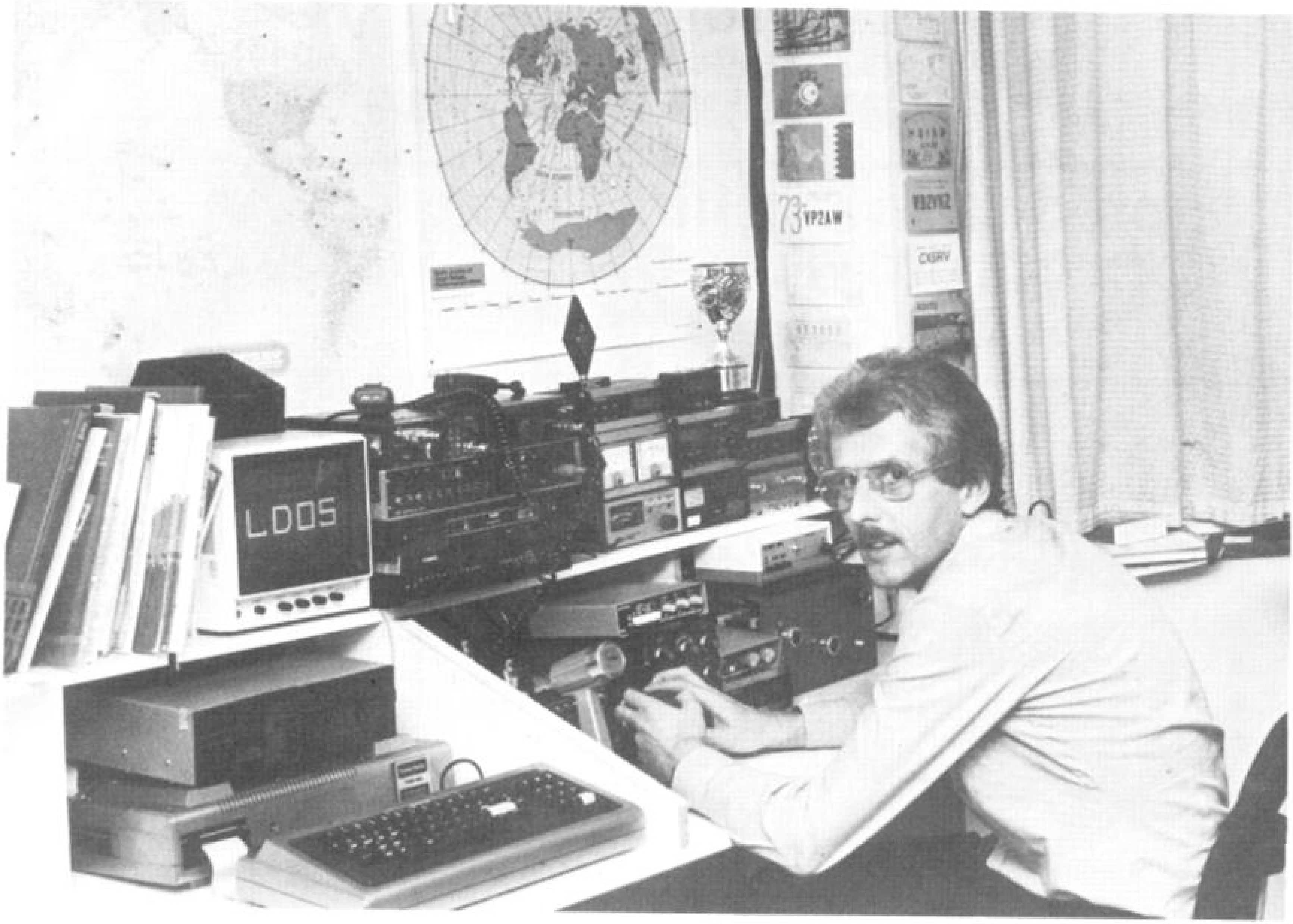
POKE 23609,X — This gives the keyboard click varying duration. When X = 0, you hear the standard click. However, the value of X can be between 0 and 255, but when numbers greater than 10 are used, even though the feedback bleep is more noticeable, there is also a noticeable difference in the speed of the auto-repeat facility. This can be frustrating when editing long program lines. It also does not work with INKEY$.

POKE 23658,X — When this location is POKEd with a zero, it disengages the Caps Shift lock. When POKEd with an eight, it engages the Caps Shift lock. This can be very convenient as it saves checking for capital or lower case letters when a user is INPUTing information to a program.

POKE 23692, >1 — This will ensure that the program will not stop with the message, 'Scroll? '. In this case, the PRINTing is started at co-ordinates 21,0 which would normally present you with that smashing little five letter word. Try omitting the POKE 23692 lines and have a look what happens!

In the FOR b NEXT b loop, i$ is attacked at the first letter and is turned into its Morse equivalent by READing the DATA the requisite number of times as set in line 95.

Once you get used to the program, the PAUSE times can be easily changed if you begin to find them a bit slow. Ex-ZX81 users who are dubious of utilising the PAUSE instruction due to the twitching screen syndrome need have no fears.

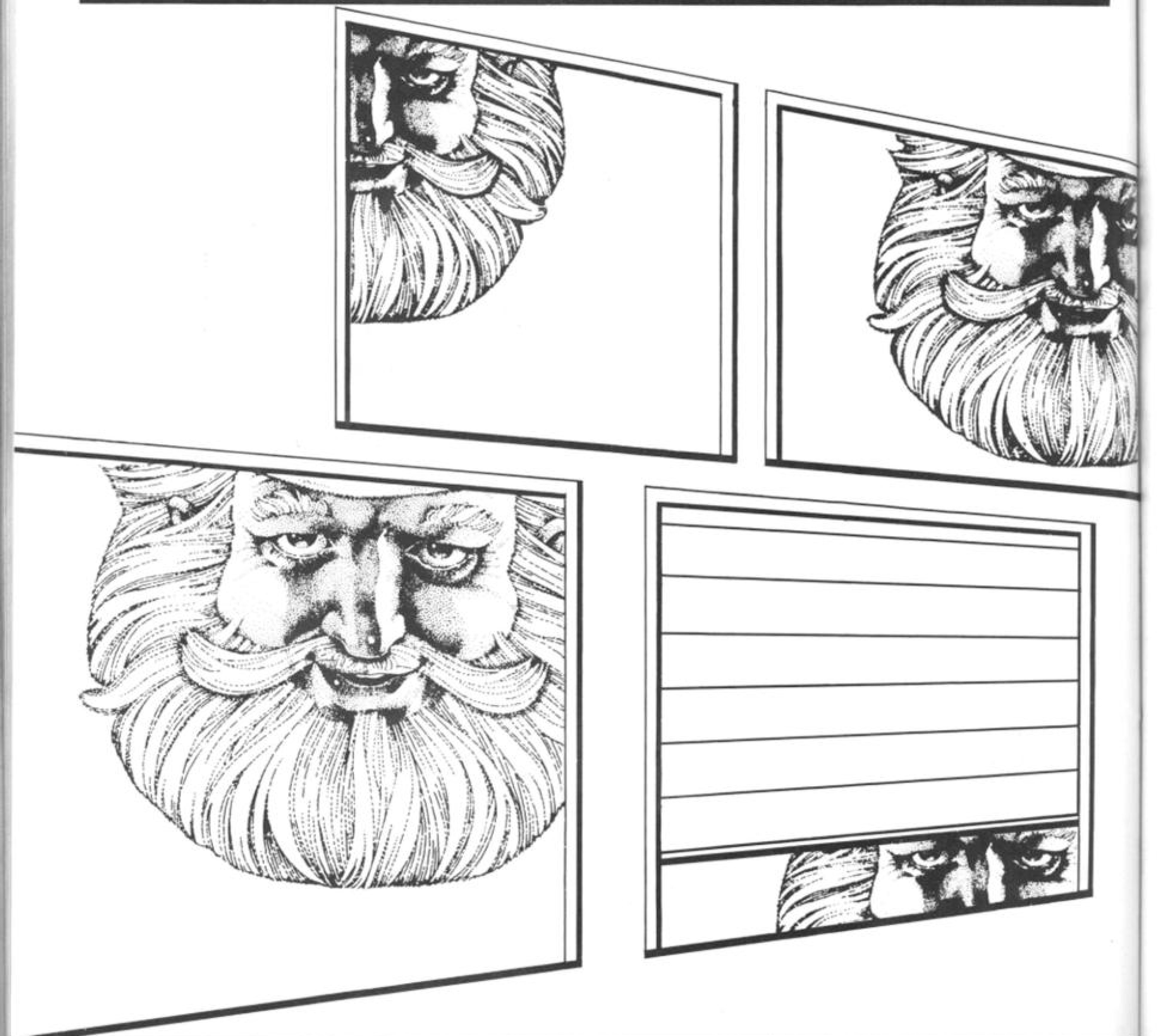



```
   1 REM Morse trainer

   5 POKE 23609,20
  10 DIM m$(7)
  15 DIM i$(250)
  20 INPUT "PITCH",P
  25 INPUT "SPEED",S
  35 LET H=S/100: LET T=S/300
  40 POKE 23658,8
  45 INPUT "X=alter speed/pitch
T=TEST","N=new phrase    ENTER=re
peat"; LINE A$
  50 IF A$="" THEN GO TO 70
  55 IF A$="X" THEN GO TO 20
  60 IF A$="T" THEN GO TO 300
  65 INPUT "ENTER Letter or Word
", LINE i$
  70 POKE 23692,2
  75 PRINT AT 21,0;"
                                "
  80 FOR b=1 TO LEN i$
  85 IF i$(b)="0" THEN LET m$="
"
  90 IF i$(b)=" " THEN GO TO 40
  95 FOR r=1 TO (CODE i$(b)-64)
 100 READ m$: NEXT r
 105 RESTORE
 110 PRINT m$( TO )
 115 POKE 23692,2
 120 GO SUB 200
 125 NEXT b
 130 GO TO 40
 150 DATA "A.-","B-...","C-.-.",
"D-..","E.","F..-.","G--.","H...
.","I..","J.---","K-.-","L.-..",
"M--","N-.","O---","P.--.","Q--.
-","R.-.","S...","T-","U..-","V.
..-","W.--","X-..-","Y-.--","Z--
.."
 200 FOR N=2 TO 6
 210 IF m$(n)="-" THEN BEEP H,P
 220 IF m$(n)="." THEN BEEP T,P
 230 NEXT N
 240 RETURN
 300 CLS : PRINT "I will give yo
u a morse letter  and I want you
 to tell me what  it is in 3 att
empts                Press ENTER
to escape ": PAUSE 100
 305 LET c=0
 310 FOR r=1 TO ((RND*26)+1)
 315 READ m$
 320 NEXT r
 325 RESTORE
 330 GO SUB 200
 335 INPUT "WHAT WAS IT? "; LINE
 N$
 340 IF N$="" THEN CLS : GO TO 4
0
 345 IF CODE N$>90 OR CODE N$<65
 THEN GO TO 335
 350 IF N$=m$(1) THEN PRINT : PR
INT : PRINT "Correct it was ";m$
 355 IF N$=m$(1) THEN PAUSE 50:
GO SUB 200: PAUSE 200: GO TO 300
 360 PRINT : PRINT : PRINT "Wron
g it was not ";N$;: PAUSE 75
 365 LET c=c+1
 370 IF c=3 THEN PRINT " It was
";m$: PAUSE 50: GO SUB 200: PAU
SE 120: GO TO 300
 375 PRINT " TRY AGAIN": PAUSE 5
0
 380 GO TO 330
```

Peeper

Someone's watching you! A paranoid program from David Wilkins of Liphook in Hampshire.





In this game for your 16K ZX81, you are looking up at a four storey building. On each floor, there are five windows . . . and someone keeps looking out of them at you.

From your vantage point, you have a good view of the windows and whenever a face appears at one of the windows, you have the opportunity to fire a shot at it before it disappears.

Going stare crazy

A total of thirty heads could look at you, although the window they will choose will be random each time. When a face appears at a window, you must position your character directly underneath using the '5' key to go left and the '8' key to go right. Then you can fire at the face; to fire a shot at a head on the first floor, press the '1' key, for a shot at the second floor press the '2' key, and so on.

Each time you hit a head, you score a total of 200 points. However, firing at higher level floors uses up more energy than firing at the lower floors; a first floor shot will cost you 10 points, a second floor shot will count for 25 points, 50 points for a third floor shot and 100 points for a shot at a head on the fourth floor.

You start off the game with 1,000 points, but you'll soon find that a few missed shots at the fourth floor will soon deplete your score. The game ends after 30 heads have appeared at the window or if you run out of points.

The game also includes a high score feature and instructions for the game's operation are included within the program.

```
   1 REM ***PEEPER***
   3 LET HI=0
   4 LET S=1000
   5 LET Z=15
   6 PRINT "YOU ARE ▟. TO MOVE LEFT PRESS"
   7 PRINT "5, TO MOVE RIGHT PRESS 8. TO"
   8 PRINT "FIRE PRESS 1 FOR A FIRST FLOOR"
   9 PRINT "PRESS 2 FOR A SECOND FLOOR."
  10 PRINT "PRESS 3 FOR A THIRD FLOOR AND"
  11 PRINT "PRESS 4 FOR A FOURTH FLOOR"
  12 PRINT "PRESSING 1 COSTS 10 POINTS, "
  13 PRINT "PRESSING 2 COSTS 25, 3 COSTS 50"
  14 PRINT "AND 4 COSTS 100. DESTROYING A"
  15 PRINT "HEAD EARNS 200 POINTS. THE GAME"
  16 PRINT "ENDS EITHER AFTER 30 GOES OR"
  17 PRINT "WHEN YOU RUN OUT OF POINTS"
  18 PRINT
  19 PRINT "PRESS ANY KEY TO PLAY"
  20 IF INKEY$="" THEN GOTO 20
  21 CLS
  22 GOSUB 24
  23 GOTO 55
  24 PRINT AT 2,5;"██████████████████████"
  25 FOR A=1 TO 4
  30 PRINT "██████████████████████"
  40 PRINT "     █    █    █    █    █"
  50 PRINT "     █    █    █    █    █"
  60 NEXT A
  62 PRINT "██████████████████████████████"
  63 RETURN
  55 FOR T=1 TO 30
  70 LET B=INT (RND*4)+1
  80 LET C=(3*B)+2
  90 LET D=INT (RND*5)
 100 LET E=(D*4)+7
 105 PRINT AT 0,0;"SCORE: ";S;" "
 110 PRINT AT C,E;"O"
 120 PRINT AT 18,Z;"▟"
 122 LET A$=INKEY$
 130 IF INKEY$="5" THEN LET Z=Z-1
 140 IF INKEY$="8" THEN LET Z=Z+1
 143 IF A$="5" THEN PRINT AT 18,Z+1;" "
 146 IF A$="8" THEN PRINT AT 18,Z-1;" "
 150 IF Z<0 THEN LET Z=31
 160 IF Z>31 THEN LET Z=0
 167 PRINT AT 18,Z;"▟"
 170 IF INKEY$<>"" THEN GOTO 120
 175 FOR P=1 TO 15
 180 IF INKEY$="1" THEN GOSUB 1000
 190 IF INKEY$="2" THEN GOSUB 1100
 200 IF INKEY$="3" THEN GOSUB 1200
 210 IF INKEY$="4" THEN GOSUB 1300
 220 NEXT P
 230 PRINT AT C,E;" "
 233 PRINT AT 16,Z;" ";AT 17,Z;" "
 235 GOSUB 24
 240 NEXT T
 250 GOTO 2000
1000 LET Q=5
1002 LET S=S-10
1005 FOR H=1 TO Q
1010 PRINT AT 18-H,Z;"."
1030 IF Z=E AND 18-H=C THEN LET S=S+200
1035 IF Z=E AND 18-H=C THEN PRINT AT C,E;"*"
1038 IF Z=E AND 18-H=C THEN LET P=15
1040 NEXT H
1050 IF S<=0 THEN GOTO 2000
1060 RETURN
1100 LET Q=8
1105 LET S=S-25
1110 GOTO 1005
1200 LET Q=11
1205 LET S=S-50
1210 GOTO 1005
1300 LET Q=14
1305 LET S=S-100
1310 GOTO 1005
2000 FOR I=1 TO 150
2010 NEXT I
2015 IF S>HI THEN LET HI=S
2020 CLS
2030 PRINT AT 5,0;"GAME OVER YOUR SCORE WAS ";S
2035 PRINT
2036 PRINT "THE HIGH SCORE IS ";HI
2040 PRINT
2050 PRINT "PRESS ANY KEY TO PLAY AGAIN"
2060 PAUSE 40000
2065 CLS
2070 GOTO 4
```

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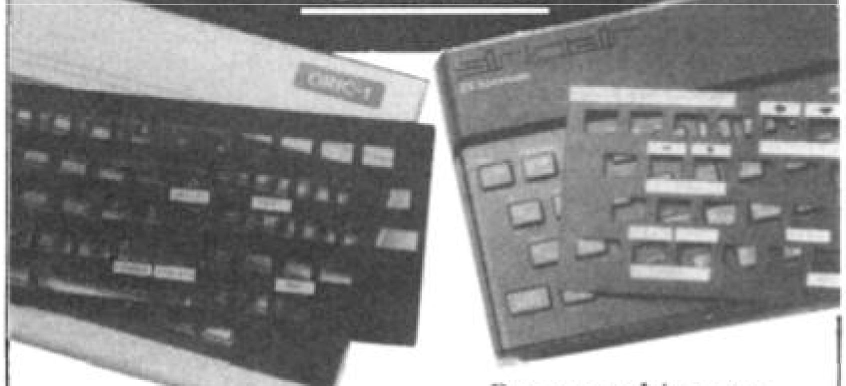
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An apple a day . . .

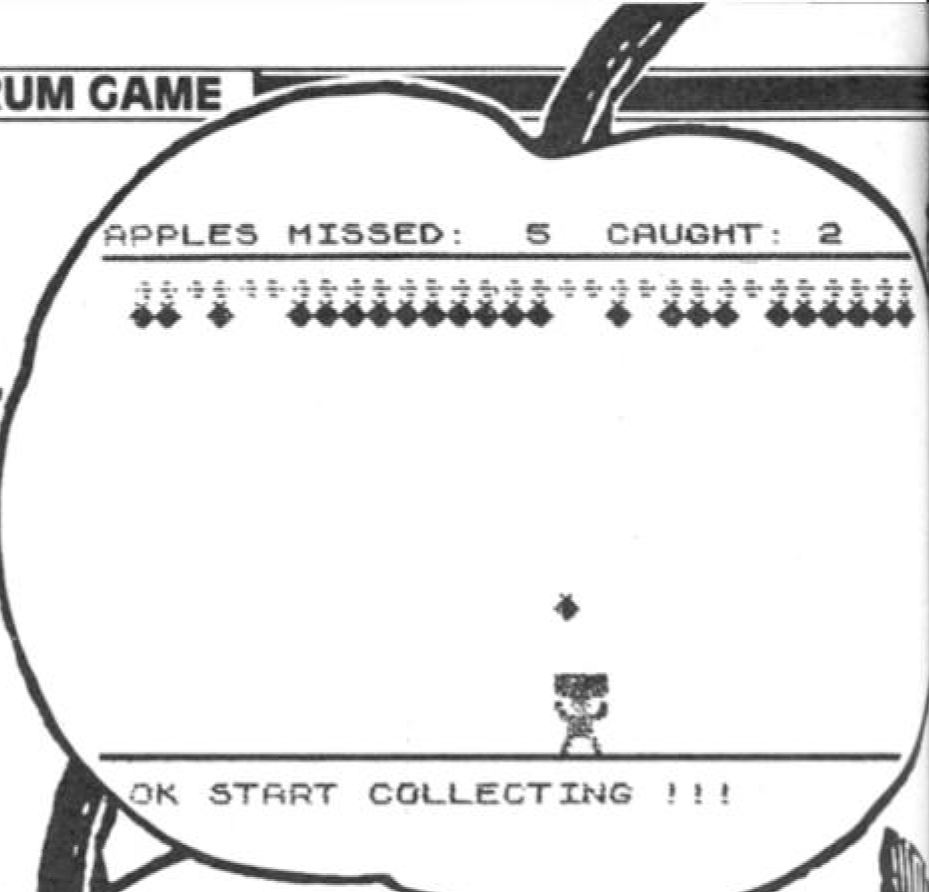
A program to keep the doctor away, written for us by Russell Morgan of Clevedon.

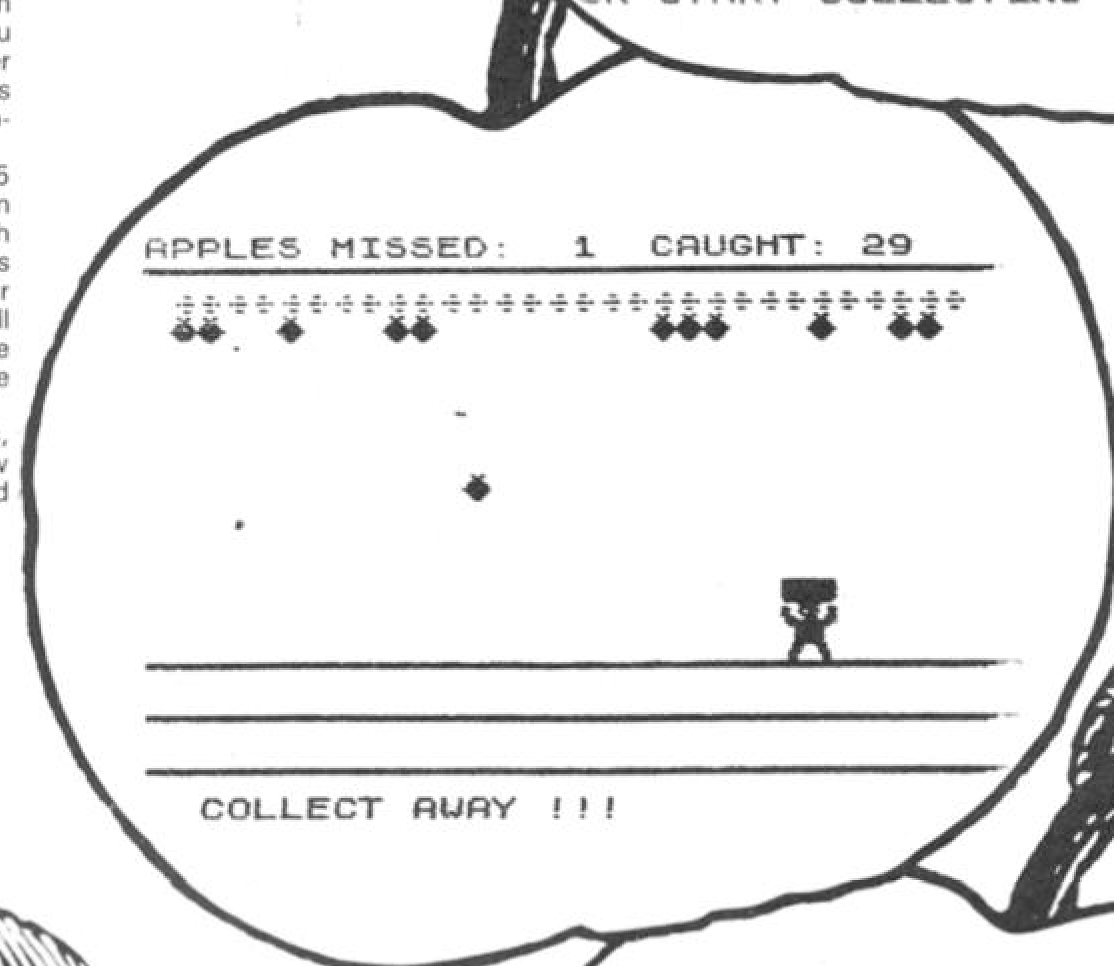
Here's a game to set you on the path to health — you collect apples as they fall off the tree!

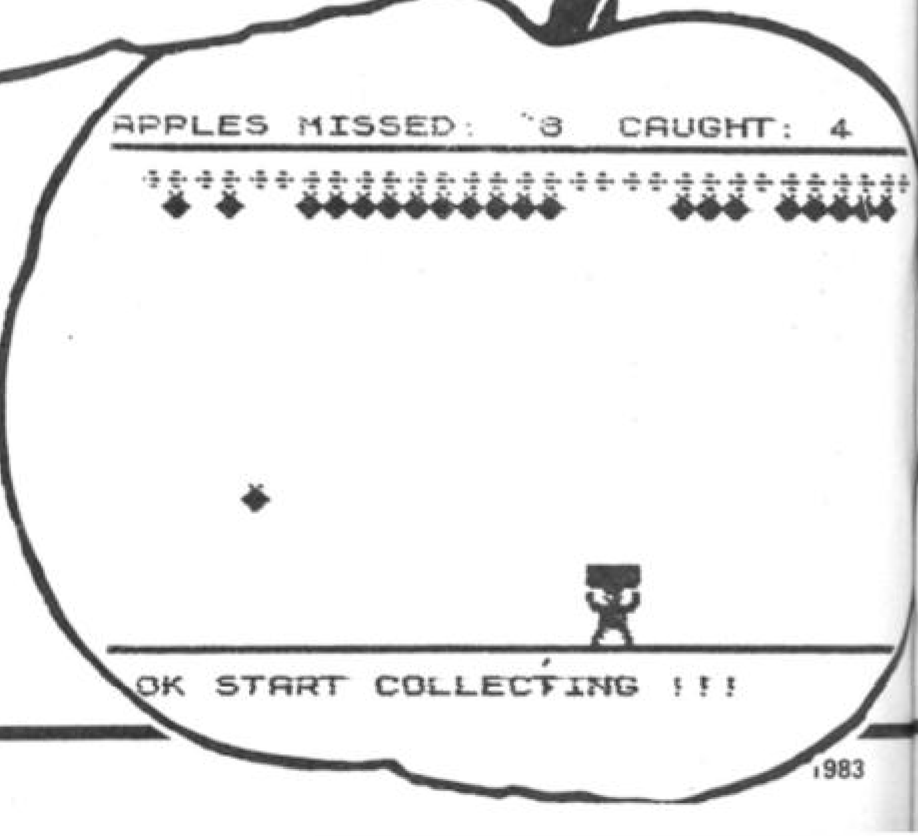
Using the '5' key to move left and the '8' key to move right, you control the figure beneath the branch of apples at the top of the screen. The apples fall from the tree one at a time and you have to position your character so that the basket it holds is directly beneath the falling apple.

When you have caught 15 apples, or a multiple of 15, then you move up a row — which means the apple has less distance to fall thus making your task harder. There are three skill levels, level one being the hardest and level three the easiest.

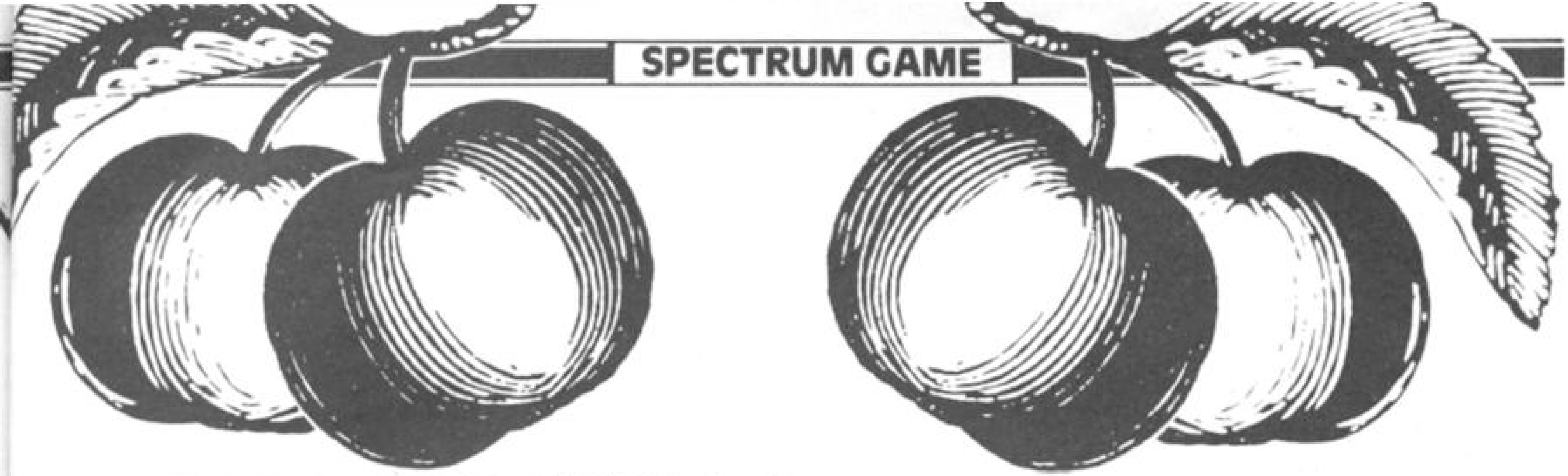
Should you miss 10 apples, then the game ends with a few bars of music and you are invited to have another game.







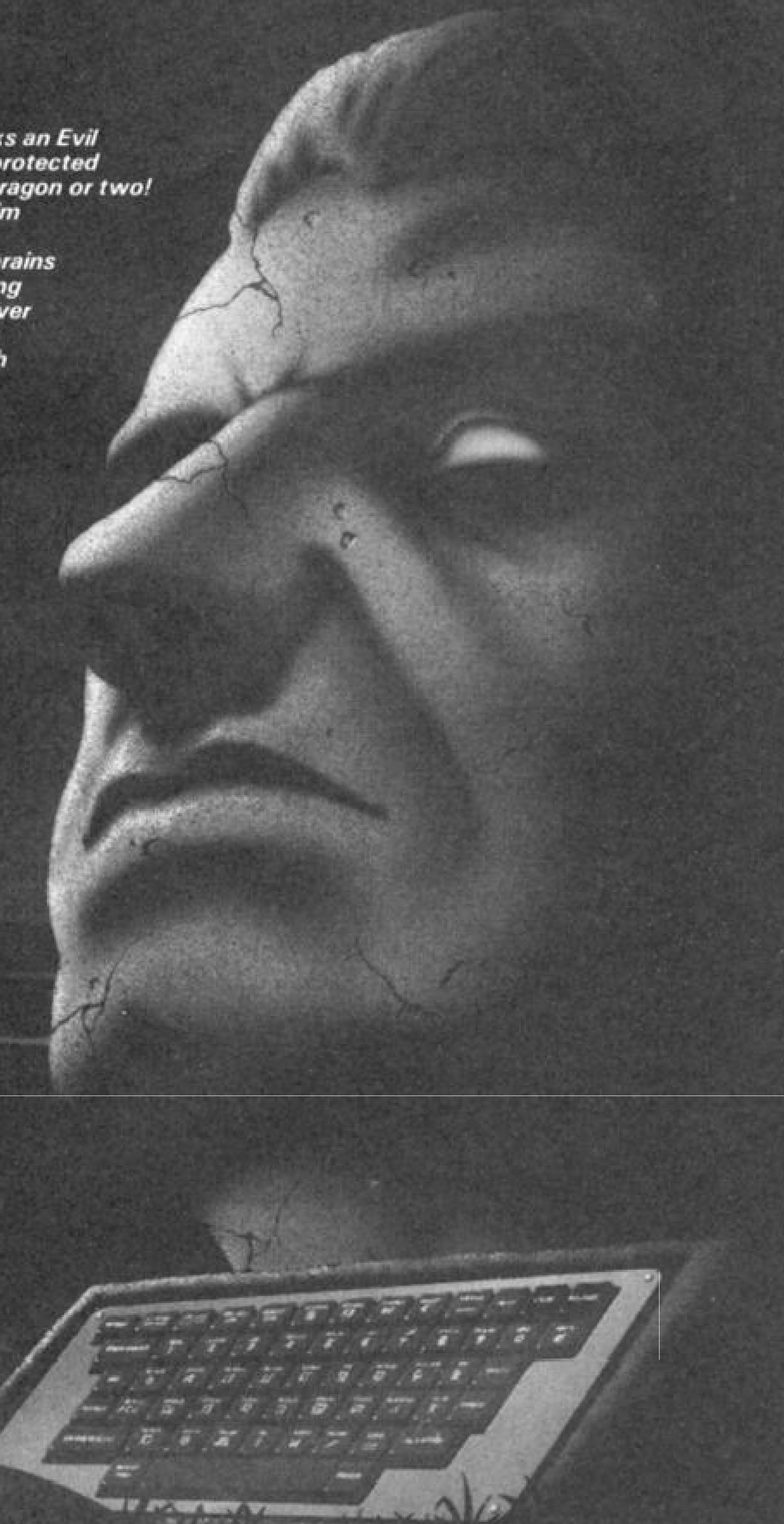




```
   1 PAPER 0: INK 7: BORDER 0: C
LS : PRINT AT 0,10;" APPLE CATCH
ER ": PRINT : PRINT "
 BY R. MORGAN": PRINT : PRINT "C
OLLECT THE APPLES AS THEY FALL":
 PRINT : PRINT "     DO NOT DROP
TEN APPLES": PRINT : PRINT "
USE ARROW KEYS TO MOVE": PRINT :
 PLOT 100,25: DRAW INK 6;50,50,6
7321.777: PRINT INK 2;"      HIT
ANY KEY TO START": PAUSE 0
   2 POKE 23693,42: CLS : INPUT
" SKILL LEVEL 1,2,3  (1 HARD) ";
FGH
   3 IF FGH <1 OR FGH>3 THEN GO
TO 2
   4 BORDER 4: PAPER 6: CLS
   6 LET a=19: LET vc=0: LET ef=
0: LET AB=0: LET BC=0: LET b=0:
LET b=14: LET t=1: LET aa=1: LET
 cc=2: LET zx=7: LET qq=2: LET c
f=12: LET ttt=4445: LET q=15: LE
T w=165: LET aaa=0: LET ggg=98
   7 REM *********************
         *   DEFINE UDG'S     *
         *********************
  10 FOR y=144 TO 150
  20 FOR z=0 TO 7
  30 READ x: POKE USR (CHR$ y)+z
,x
  40 NEXT z: NEXT y
  50 POKE 23692,255
  60 DATA 36,24,60,126,255,126,6
0,24,255,255,255,255,255,255,127
,7,255,255,255,255,255,255,254,2
24,195,196,195,113,127,63,15,15,
195,163,195,199,254,252,240,240,
15,15,15,28,24,56,48,48,240,240,
240,56,24,28,12,12
  70 GO SUB 2000
  71 GO SUB 2301
  75 REM *********************
         ***   START GAME    ***
         *********************
  78 INK 0
  79 PRINT AT a+1,b;"    ": PRIN
T AT a+2,b;"    ": LET a=a-2: PR
INT AT 21,0;" OK START COLLECTIN
G !!!     "
  80 INK 0: PLOT 0,q: DRAW 255,0
  81 PLOT 0,q-1: DRAW 255,0
  83 PLOT 0,w-1: DRAW 255,0
  84 LET ef=9: PLOT 0,w: DRAW 25
5,0
  85 LET q=q+16: LET bc=vc
  86 IF ttt=2 THEN PRINT AT 21,0
;"   COLLECT AWAY !!!
"
  87 FOR k=1 TO fgh
  89 IF INKEY$="" THEN : PAUSE 2
: NEXT k
  90 IF INKEY$="5" THEN LET b=b-
1
  92 IF INKEY$="8" THEN LET b=b+
1
  93 IF b=-1 THEN LET b=0
  94 IF b=29 THEN LET b=28
 110 PRINT AT a,b; INK 1;" BC "
 120 PRINT AT a+1,b; INK 3;" DE
"
 130 PRINT AT a+2,b; INK 3;" FG
"
 135 NEXT k
 139 GO SUB 3000
 140 GO TO 87
2000 PRINT INK 0,AT 0,0;"APPLES
MISSED:  0   CAUGHT:  0"
2300 RETURN
2310 IF t=1 THEN PRINT INK 0,AT
21,0;" OK START COLLECTING !!!
  "
2319 GO TO 2340
2320 IF t=2 THEN LET t=1
2400 RETURN
3000 IF aa=1 THEN PRINT AT 3,1;
INK 4;"AAAAAAAAAAAAAAAAAAAAAAAAA
AAAAA"
3030 IF aa=1 THEN PRINT INK 4, O
VER 1,AT 2,0;" <><><><><><><><><
><><><><><><> "
3040 IF aa=1 THEN PRINT INK 4; O
VER 1,AT 2,0;" +++++++++++++++++
++++++++++++++ "
3200 LET aa=0
3250 IF cc=56 THEN GO TO 3400
3300 LET bb=INT (RND*30)+1
3330 LET df=0: IF qq=2 THEN LET
ee=bb: LET df=0: LET qq=255: LET
 ff=3: LET cc=556: RETURN
3350 IF aaa=15 THEN LET vc=bc: L
ET bc=0: LET ttt=2: LET aaa=0: G
O TO 71
3360 LET cc=56
3400 LET ff=ff+1
3401 IF bc =10 THEN : INK 0: BOR
DER 4: POKE 23693,252: GO SUB 40
00: CLS : PRINT AT 12,11;"GAME O
VER": PRINT : PRINT : PRINT "
   YOU CAUGHT ";ab;" APPLES": PR
INT : PRINT "  HIT ANY KEY FOR A
NOTHER GAME": PAUSE 0: RUN 2
3402 IF ff>=a+3 THEN BEEP .4,-20
: LET bc=bc+1: PRINT AT 0,16;bc:
 LET cc=3: LET aaa=aaa+1: LET qq
=2: PRINT AT ff-1,bb;" ": LET ff
=3: LET bb=0: RETURN
3420 PRINT AT ff-1,bb;" "
3430 IF ff>=a+3 THEN GO TO 3450
3440 PRINT INK 4;AT ff,bb;"A": B
EEP .009,df: LET df=df+2
3450 IF ff+1=a AND bb=b+1 OR ff=
a AND bb=b+1 OR ff+1=a AND bb=b+
2 THEN PRINT AT ff,bb;" ": LET a
aa=aaa+1: FOR h=38 TO 48: BEEP .
003,h: NEXT h: LET ab=ab+1: PRIN
T INK 0,AT 0,27;ab: LET cc=255:
LET ff=3: LET bb=0: GO TO 3250
3500 RETURN
4000 RESTORE 5000: FOR n=0 TO 15
: READ a,b: BEEP a/5,b: NEXT n:
RETURN
5000 DATA .8,0,.8,2,.4,3,.4,2,.8
,0,.8,0,.8,2,.4,3,.4,2,.8,0,.8,3
,.8,5,1.6,7,.8,3,.8,5,1.6,7
9999 RETURN
```

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The house of horror

Dare you enter the haunted house? Find out in this program for your 16K ZX81 from Chris Cox of Truro.

It was a dark and stormy night (as Victorian writer, Edward Bulwer Lytton, used to say) when Chris Cox decided to write this program!

The plot of the game is that you have been transported to a deserted mansion, full of hidden treasure. All of the treasure was kindly left by the last owner of the house, but unfortunately he also left a number of his 'pets' to guard his fortune. And yes, you've guessed it, his 'pets' (in the shape of monsters!) are none too pleased by your intrusion. And if that wasn't enough, you have to watch out for the roaming reaper who has a liking for people's heads — it's not too interested in the rest of your body though (need I say more!).

Instructions appear throughout the program telling you in which direction you can go. You move around the randomly-generated selection of halls and stairways constantly exploring until you find treasure, keys to open some of the locked doors and, of course, a grim selection of monsters.

The more coins you find, the less frequent large finds become; however, as you come across less coins, you'll find more keys and have more encounters which means you can explore more of the house.

The game ends when you have found over 2,500 coins, run out of strength warding off the monsters or you've had your head removed by the roaming reaper!

Happy hunting!



Photographs courtesy of Universal City Studios and Warner Bros.

```
  10 LET H=0
  20 LET S=200
  30 LET C=0
  40 LET K=0
  50 LET M=0
  55 PRINT AT 3,9;"""THE HOUSE"""
  60 PRINT AT 8,4;"INSTRUCTIONS
FOLLOW"
  70 PAUSE 200
  80 CLS
  90 PRINT AT 2,10;"THE HOUSE."
 100 PRINT TAB 10;"----------"
 110 PRINT
 120 PRINT
 130 PRINT "     YOU HAVE BEEN TRA
NSPORTED TO"
 140 PRINT "A DESERTED MANSION.A
LL AROUND IT"
 150 PRINT "TREASURE IS HIDDEN.I
T WAS LEFT"
 160 PRINT "BY THE LAST OWNER."
 170 PRINT
 180 PRINT "AS WELL AS HIS TREAS
URE HE LEFT"
 190 PRINT "HIS PET MONSTERS TO
GUARD IT."
 200 PRINT "BEWARE THE CLUTCHES
OF THE ROAM-"
 210 PRINT "ING REAPER..........
............"
 220 PRINT AT 21,0;"PRESS ANY KE
Y TO START."
 230 PAUSE 3000
 240 CLS
 250 LET A$=" A HALL."
 260 LET B$=" A DOOR."
 270 LET C$=" A STAIRWAY."
 280 LET A=INT (RND*3)+1
 290 IF A=1 THEN LET X$=C$
 300 IF A=2 THEN LET X$=A$
 310 IF A=3 THEN LET X$=B$
 320 IF A>3 THEN LET X$=A$
 330 PRINT AT 21,0;"YOU ARE FACI
NG";X$
 340 SCROLL
 350 SCROLL
 360 IF X$=A$ THEN GOSUB 420
 370 IF X$=B$ THEN GOSUB 480
 380 IF X$=C$ THEN GOSUB 530
 390 SCROLL
 400 SCROLL
 410 GOTO 250
 420 PRINT "(1) MOVE (2) EXPLORE
(3) STATUS"
 430 INPUT B
 440 IF B=1 THEN GOSUB 590
 450 IF B=2 THEN GOSUB 640
 460 IF B=3 THEN GOSUB 710
 470 RETURN
 480 PRINT "(1) OPEN (2) LEAVE"
 490 INPUT Z
 500 IF Z=1 THEN GOSUB 870
 510 IF Z=2 THEN RETURN
 520 RETURN
 530 PRINT "(1) UP (2) DOWN (3)
LEAVE"
 540 INPUT D
 550 IF D=1 THEN GOSUB 910
 560 IF D=2 THEN GOSUB 980
 570 IF D=3 THEN RETURN
 580 RETURN
 590 SCROLL
 600 SCROLL
 610 PRINT "(1)NORTH(2)SOUTH(3)E
AST(4)WEST"
 620 INPUT X
 630 RETURN
 640 SCROLL
 650 SCROLL
 660 LET A=INT (RND*3)+1
 670 IF A>2 THEN GOSUB 1520
 680 IF A=1 THEN GOSUB 1070
 690 IF A=2 THEN GOSUB 1450
 700 RETURN
 710 CLS
 720 PRINT AT 3,10;"STATUS"
 730 PRINT
 740 PRINT
 750 PRINT TAB 4;"STRENGTH
";S
 760 PRINT
 770 PRINT TAB 4;"COINS
";C
 780 PRINT
 790 PRINT TAB 4;"KEYS
";K
 800 PRINT
 810 PRINT TAB 4;"MONSTERS DEAD
";M
 820 PRINT AT 15,6;"SCORE ";((S*
2)+C+(K*5)+(M*11))
 830 PRINT AT,21,0;"PRESS ANY KE
Y TO CONTINUE......"
 840 PAUSE 3000
 850 CLS
 860 RETURN
 870 LET X=INT (RND*4)+1
 880 IF X<3 THEN GOSUB 1550
 890 IF X>2 THEN GOSUB 1630
 900 RETURN
 910 LET X=INT (RND*2)+1
 920 SCROLL
 930 SCROLL
```

```
 940 IF X<3 THEN PRINT "O.K. YOU
RE UP A FLOOR"
 950 IF X>2 THEN PRINT "NO WAY U
P THERE."
 960 IF RND>.7 THEN GOSUB 1050
 970 RETURN
 980 LET A=INT (RND*2)+1
 990 SCROLL
1000 SCROLL
1010 IF A<3 THEN PRINT "O.K. YOU
RE DOWN A FLOOR"
1020 IF A>2 THEN PRINT "NO WAY D
OWN THERE."
1030 IF RND>.7 THEN GOSUB 1050
1050 SCROLL
1060 SCROLL
1070 LET A=INT (RND*9)+1
1080 IF A<3 THEN LET M$=" A TROL
L."
1090 IF A=3 THEN LET M$="A GARGO
YLE"
1100 IF A=4 THEN LET M$=" A VAMP
IRE."
1110 IF A=5 THEN LET M$=" A WERE
WOLF."
1120 IF A=6 THEN LET M$=" A HYDR
A."
1130 IF A=7 THEN LET M$=" A SHIL
O."
1145 IF A=8 THEN LET M$=" A MEDU
SA."
1150 IF A>8 THEN LET M$=" THE RE
APER."
1170 PRINT "YOUVE MET";M$
1180 SCROLL
1185 SCROLL
1190 PRINT "(1) ATTACK (2) RETRE
AT"
1200 INPUT B
1210 IF B=2 AND A<6 THEN RETURN
1220 IF B=1 THEN GOTO 1260
1230 SCROLL
1240 SCROLL
1250 PRINT "HE DOES NOT LIKE COW
ARDS."
1260 LET A=INT (RND*99)+1
1270 SCROLL
1280 SCROLL
1290 PRINT "HE HAS A PUNCH FACTO
R OF ";A
1300 SCROLL
1310 SCROLL
1320 PRINT "INPUT PUNCH FACTOR (
1-9)"
1330 INPUT P
1340 LET PF=P*5
1350 LET S=S-(PF/2)
1355 IF S<1 THEN GOTO 2110
1360 IF PF>A THEN GOTO 1390
1365 IF A<1 THEN GOTO 1390
1370 LET A=A-PF
1380 GOTO 1270
1390 SCROLL
1400 SCROLL
1410 PRINT "YOU WON.STRENGTH IS
NOW ";S
1415 LET M=M+1
1420 RETURN
1430 SCROLL
1440 SCROLL
1450 LET A=INT (RND*500)+50
1460 PRINT "YOUVE FOUND ";A;"COI
NS."
1470 LET C=C+A
1475 LET S=S-10
1480 IF C>2500 THEN GOTO 1860
1490 RETURN
1500 SCROLL
1510 SCROLL
1520 PRINT "YOUVE FOUND A KEY."
1530 LET K=K+1
1535 LET S=S+20
1540 RETURN
1550 SCROLL
1560 SCROLL
1570 PRINT "DOOR LOCKED.GOT A KE
Y ?"
1580 IF K<1 THEN RETURN
1590 SCROLL
1600 SCROLL
1610 PRINT "YES."
1620 LET K=K-1
1630 SCROLL
1640 SCROLL
1650 PRINT "THE DOOR HAS OPENED.
"
1660 LET A=INT (RND*4)+1
1670 IF A=2 THEN GOSUB 1430
1680 IF A=3 THEN GOSUB 1500
1690 IF A<2 OR A>3 THEN GOSUB 10
50
1700 RETURN
1710 CLS
1720 PRINT AT 3,10;"THE END."
1730 PRINT TAB 10;"--------"
1740 PRINT AT 6,0;"   YOU MET YO
UR END IN THE HANDS"
1750 PRINT "OF THE REAPER.HE CUT
 YOUR HEAD"
1760 PRINT "OFF."
1770 PRINT
1780 PRINT "    BEFORE YOU DIED Y
OU SCORED"
1790 PRINT ((S*2)+C+(K*5)+(M*11)
);" POINTS."
1795 PRINT
1800 PRINT "    YOU FOUND ";C;" C
OINS."
1810 PRINT
1820 PRINT TAB 10;"WELL DONE."
1830 GOTO 2030
1840 STOP
1850 STOP
1860 CLS
1870 PRINT AT 2,10;"THE HOUSE."
1880 PRINT TAB 10;"----------"
1890 PRINT
1900 PRINT
1910 PRINT "    YOUVE BEATEN THE
HOUSE AND"
1920 PRINT
1930 PRINT "ITS HORRORS."
1940 PRINT
1950 PRINT "    WELL DONE.YOU FOU
ND ";C
1960 PRINT
1970 PRINT "COINS DURING THE GAM
E,AND HAVE"
1980 PRINT
1990 PRINT K;" KEYS LEFT.YOU ALS
O KILLED"
2000 PRINT
2010 PRINT M;" MONSTERS."
2020 PRINT
2030 PRINT
2040 IF H<((S*2)+C+(K*5)+(M*11))
 THEN LET H=((S*2)+C+(K*5)+(M*11
))
2050 PRINT TAB 6;"HIGHEST SCORE"
2055 PRINT TAB 10;H
2060 PRINT AT 21,0;"ANOTHER GO (
Y/N)"
2070 INPUT A$
2080 IF A$="N" THEN STOP
2090 CLS
2100 GOTO 20
2110 CLS
2120 PRINT AT 2,10;"THE HOUSE."
2130 PRINT TAB 10;"----------"
2140 PRINT
2150 PRINT
2160 PRINT "YOUVE RUN OUT OF STR
ENGTH."
2170 PRINT
2180 PRINT "THE HOUSE HAS WON AG
AIN."
2190 GOTO 2030
```

Photographs courtesy of Universal City Studios and Warner Bros.

Getting fizzical!

An adaptation of the popular game, Lemonade stand, for the Spectrum by fourteen year old Michael Guy of Runcorn.


RCA Records.

Having seen the program, Lemonade stand, adapted for a variety of micros, Michael was a little disappointed not to find a version of the game for the ZX Spectrum. So, like any enterprising programmer, he sat down and wrote one for himself. The result of his work follows in the published listing — you should enjoy it, his computer club liked it so much they awarded him a small prize!

In the drink

In the program, you are placed in charge of a lemonade stand in Hyde Park, London. You start off with a mere £10 and your object, in true capitalist fashion, is to make as much money as you can. Fortunately, there are only two major decisions you need make: how many cups to make that day and how much you intend to charge for each cup of lemonade.

Once this decision has been made, you will be greeted with a screen display of two glasses on the counter which slowly fill up. A clock appears on-screen to tell you the time of day, and you have to shut up the stand at seven o'clock.

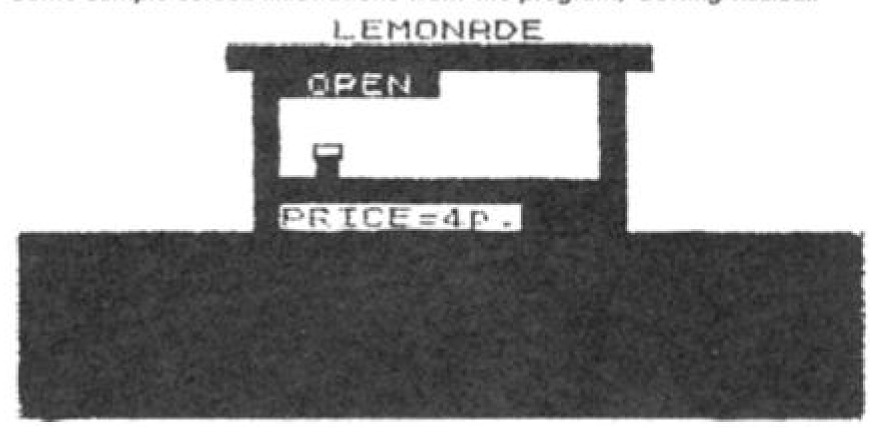
At the end of each day, you are shown a report of the day's takings, and your profit and losses are added and subtracted from your total spending money. Should you run out of money, you will be told how well you did and if you manage to last out the whole week, you will be given some praise.

Take care of the vandals though, if they wreck your stand you'll have to fork out £20 to get the repairs done!

```
   1 REM
   3 BORDER 1: PAPER 1: INK 7
   4 PRINT AT 10,5;"Press 'ENTER
 to begin": INPUT z$
   5 CLS
   6 GO SUB 5000
   7 LET l=0: LET m=1000: LET r=
50: LET p=3
   8 LET day=1
   9 GO SUB 1000
  10 CLS : IF RND>.97 AND day>2
THEN GO TO 3000
  11 PRINT AT 1,2;"REPORT"
  20 PLOT 14,159: DRAW 52,0
  25 PRINT '" DAY ";day
  30 DIM w$(6,18)
  31 LET w$(1)="cloudy"
  32 LET w$(2)="sunny"
  33 LET w$(3)="rainy"
  34 LET w$(4)="stormy"
  35 LET w$(5)="HOT"
  36 LET w$(6)="snowy"
  39 DIM a$(6,18)
  40 LET a$(1,17)=CHR$ 60
  41 LET a$(2,17)=CHR$ 60
  42 LET a$(3,17)=CHR$ 15
  43 LET a$(4,17)=CHR$ 7
  44 LET a$(5,17)=CHR$ 105
  45 LET a$(5,17)=CHR$ 2
  50 LET a$(1,18)=CHR$ 40
  51 LET a$(2,18)=CHR$ 90
  52 LET a$(3,18)=CHR$ 15
  53 LET a$(4,18)=CHR$ 10
  54 LET a$(5,18)=CHR$ 130
  55 LET a$(6,18)=CHR$ 8
 100 LET d=INT (RND*6+1)
 110 PRINT '" The weather today
is ";w$(d, TO 16)
 140 PRINT '" Lemonade Costs ";p
;"p. per cup"
 150 PRINT '" Total money=£";m/1
00
 155 IF m<0 THEN GO TO 2000
 160 PRINT AT 20,0;" How many cu
ps to be made? "
 170 INPUT c
 175 IF c>m/p THEN PRINT AT 12,0
;" You haven't enough money"
 176 IF c>m/p THEN GO TO 170
 180 PRINT AT 12,0;" No. of cups
made is ";c;" "
 190 PRINT AT 20,0;" Sale price
for each cup? "
 200 INPUT l
 205 IF l>40 THEN GO TO 200
 210 PRINT AT 14,0;" Sale price=
";l;"p. per cup"
 215 PAUSE 50
 220 PRINT AT 20,0;" press a key
 to open your stall"
 230 IF INKEY$="" THEN GO TO 230
 240 GO SUB 1000
 250 LET t=9
 260 PRINT AT 2,1;"TIME: ";t;":0
0 "
 265 PAUSE 30
 270 LET t=t+1
 280 IF t=13 THEN LET t=1
 290 IF t<>8 THEN GO TO 260
 300 PRINT AT 9,10; PAPER 0; INK
 6;"CLOSED"
 310 PAUSE 50
 320 LET n=RND*CODE (a$(d,17))+R
ND*CODE (a$(d,18))
 330 LET a=INT (n-(1/(10-(l-p)))
*n)
 340 IF a>c THEN LET a=c
 350 CLS : PRINT AT 1,2;"SALES R
EPORT"
 360 PLOT 14,159: DRAW 98,0
 370 PRINT '" No. of cups sold="
;a
 380 PRINT '" Money in the till
=£";(a*l)/100
 390 PRINT '" Wholesalers bill=
£";(c*p)/100
 400 PRINT '" RENT=£";r/100
 410 PRINT '" PROFIT FOR THE DA
Y=£";(l*a-c*p-r)/100
 420 LET m=m+(l*a-c*p-r)
 430 IF m<0 THEN GO TO 2000
 440 LET day=day+1
 450 IF day=8 THEN GO TO 2500
 460 IF RND>.6 THEN LET p=p+1
 480 PRINT AT 20,0;" Press a Key
 to continue"
 490 IF INKEY$="" THEN GO TO 490
 500 GO TO 9
 999 STOP
1000 REM Graphic set up
1001 CLS
1005 BORDER 6: PAPER 1
1010 FOR a=15 TO 21
1020 PRINT AT a,0; INK 4;"[redacted]"
1030 NEXT a
1040 PRINT AT 7,11; PAPER 7; INK
 0;" LEMONADE "
1050 INK 6: PRINT AT 8,8;"[redacted]"
```

```
1060 FOR a=9 TO 12
1070 PRINT AT a,9;"█";AT a,22;"█
"
1080 NEXT a
1090 FOR a=13 TO 17
1100 PRINT AT a,9;"█████████████
█"
1110 NEXT a
1115 PRINT AT 9,10;"OPEN"
1120 PRINT AT 14,10; PAPER 7; IN
K 0;"PRICE=";l;"p."
1125 INK 5
1130 PLOT 90,81: DRAW 1,-9
1140 PLOT 98,81: DRAW -1,-9
1150 PLOT 90,81: DRAW 8,0
1151 FOR a=72 TO 78
1152 PLOT 91,a: DRAW 6,0
1153 PAUSE 5
1154 NEXT a
1160 PLOT 105,81: DRAW 1,-9
1170 PLOT 113,81: DRAW -1,-9
1180 PLOT 105,81: DRAW 8,0
1181 FOR a=72 TO 78
1182 PLOT 106,a: DRAW 6,0
1183 PAUSE 5
1184 NEXT a
1185 PAUSE 30
1190 RETURN
2000 PAUSE 200: CLS
2010 PRINT AT 1,2;"FINAL REPORT"
2020 PLOT 14,159: DRAW 99,0
2030 PRINT '´" You lasted for ";
day;" days, until you ran out o
f money"
2040 PRINT '" You didn't do very
 well,and you are not a good sho
p keeper"
2050 PRINT AT 20,0;" Press 'ENTE
R' for another go!"
2060 IF INKEY$="" THEN GO TO 206
0
2070 CLS : GO TO 5
2500 PAUSE 200
2501 CLS
2510 PRINT AT 1,2;"FINAL REPORT"
2520 PLOT 14,159: DRAW 99,0
2530 PRINT '´" You completed you
r week in        buisness and mad
e a profit of "
2535 PRINT AT 10,5;"Total money=
£";m/100
2536 PRINT AT 11,5;"minus float=
£10"
2537 PLOT 39,79: DRAW 120,0
£536 PRINT AT 13,5;"PROFIT      =
£";(m/100)-10
2550 PRINT AT 20,0;" Press 'ENTE
R' for another go!"
2560 IF INKEY$="" THEN GO TO 256
0
2570 CLS : GO TO 5
2999 STOP
3000 CLS : BORDER 1
3010 PRINT AT 1,2;"POLICE REPORT
"
3020 PLOT 14,159: DRAW 105,0
3030 PRINT '´" The police have
informed you   that vandles have
 damaged your  property. The cos
t of repairs is £20."
3040 PRINT '´" If you cannot mee
t this bill   press 'Q'. If you
want to carry on your busness pr
ess 'ENTER'"
3050 IF INKEY$="q" THEN GO TO 60
00
3060 IF INKEY$="" THEN GO TO 306
0
3070 LET m=m-2000
3080 GO TO 9
5000 REM Instructions
5020 PRINT AT 1,9;"LEMONADE STAN
D"
5030 PLOT 70,159: DRAW 114,0
5040 PRINT '´" You have been pla
ced in charge    of a small lemon
ade stand in     Hyde Park,London
 for a week.    You start off wit
h £10 in your    pocket and you s
hould try to    make as much mone
y as possible."
5050 PRINT '" You are given the
report for       the day and you o
nly need to      make two decision
s:             How many cups to b
e made? and    At what price they
 should be      sold at?"
5060 PRINT '´'"    Press 'ENTER'
to open."
5070 IF INKEY$="" THEN GO TO 507
0
5080 RETURN
6000 PAUSE 200
6010 CLS
6030 PRINT AT 1,2;"BROKE"
6040 PLOT 14,159: DRAW 42,0
6050 PRINT '´" You finally ended
 up broke."
6055 PRINT '´" The police have j
ust told you     that the vandles
 are still on    the loose."
6060 PRINT AT 20,0;" Press 'ENTE
R' for another go!"
6070 IF INKEY$="" THEN GO TO 607
0
6080 GO TO 4
```

Some sample screen illustrations from the program, Getting fizzical.



SALES REPORT

No. of cups sold=51

Money in the till=£2.04

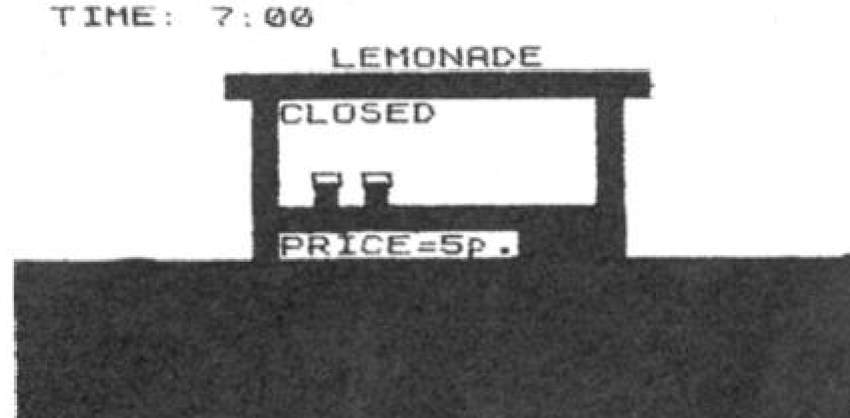
Wholesalers bill=£3

RENT=£0.5

PROFIT FOR THE DAY=£-1.46

Press a key to continue

TIME: 7:00



MACHINE SPECIFICATIONS

ZX80

Dimensions
Width 174mm (6.85 in)
Depth 218mm (8.58 in)
Height 38 mm (1. 5 in)
Weight 300g (10.5oz)

Microprocessor/Memory
Z80A 3.25 MHz clock
ROM: 4K bytes containing BASIC
RAM: 1K bytes internal, externally expandable to 16K bytes.

Display
Requires an ordinary domestic black and white colour TV. The lead supplied connects between the ZX80 and your TV's aerial socket. The display organisation is 24 lines of 32 characters per line showing black characters on a white screen. The ZX80 does not connect to a printer.

Programming
Programs can be entered on the keyboard or loaded from cassette. The ZX80 has automatic "wrap round" so lines of program can be any length but not multi-statement lines.

Syntax check
The syntax of the entered line is checked character by character. A syntax error cursor marks the first place the syntax breaks down if there is an error. Once any errors have been edited out the syntax error cursor disappears. Only syntax error-free lines of code are accepted by the ZX80.

Graphics
Total of 22 graphics symbols giving 48 x 64 pixels resolution consisting of 10 symbols plus space and inverses. Includes symbols for drawing bar charts. Under control of your BASIC program any character can be printed in reverse field.

Editing
The line edit allows you to edit any line of program or input including statement numbers. The edit and cursor control keys are EDIT, RUBOUT, HOME.

Arithmetic
Arithmetic operators +,–,x, ÷ exponentiate. Relational operators <, >, = , yielding 0 or – 1. Logical operators AND OR NOT yielding boolean result. Relational operators also apply to strings. ZX80 BASIC uses 16 bit two's complement arithmetic (± 32767).

Variables
Numeric variable names may be any length, must begin with a letter and consist of alphanumerics. Every character in the name is compared thus an infinity of unique names is available.

String variables may be assigned to or from, shortened but not concatenated. String variable names are A$ – Z$. Strings do not require a dimension statement and can be any length.

Arrays have a maximum dimension of 255 (256 elements) each. Array names consist of a single letter A–Z.

Control variable names in FOR. . . NEXT loops consist of a single letter A–Z.

Expression evaluator
The full expression evaluator is called whenever a constant or variable is encountered during program execution. This allows you to use expressions in place of constants especially useful in GOTOs, GOSUBs, FOR. . . NEXT etc.

Immediate mode
The ZX80 will function in the "calculator mode" by immediately executing a statement if it is not preceded with a line number.

Cassette interface
Works with most domestic cassette recorders. The transfer rate is 250 baud using a unique tape-recording format. Other systems are not compatible with the ZX80's. The ZX80 also SAVEs the variables as well as the program on cassette. Therefore you can save the data for updating next time the program is executed. The ZX80 does not support separate data files. The lead supplied with the ZX80 is fitted with 3.5mm jack plugs.

Expansion bus
At the rear has 8 data, 16 address, 13 control lines from the processor and Ov, 5v, 9-11v, Ø and internal memory control line. These signals enable you to interface the ZX80 to your own electronics, PIO, CTC, SIO if you want I/O ports etc.

Power supply
The ZX80 requires approximately 400mA from 7–11v DC. It has its own internal 5v regulator.

TV standard
The ZX80 is designed to work with UHF TVs (channel 36)and is the version required for use in the United Kingdom. The ZX80 USA is designed to work with a VHF TV(American channel 2. European channel 3) and is the version required for the American TV system, also for countries without UHF.

ZX81

Dimensions
Width 167mm (6.32 in)
Depth 175mm (6.80 in)
Height 40 mm (1.57 in)
Weight 350 gms (12.15 oz)

Microprocessor/Memory
Z80A 3.25 MHz clock
ROM: Containing 8K BASIC interpreter
RAM: 1K bytes internal, externally expandable to 16K bytes.

Keyboard
40 key touch-sensitive membrane. Using function mode and single press key-word system, this gives the equivalent of 91 keys and also graphics mode allows an additional 20 graphical and 54 inverse video characters to be entered directly.

Display
Requires an ordinary domestic black and white or colour TV. The aerial lead supplied connects the ZX81 to the TV aerial socket. The display is organised as 24 lines of 32 characters with black characters on a white background.

Two mode speeds
The ZX81 can operate in two software-selectable modes - FAST and NORMAL. FAST is ideal for really high-speed computing. In NORMAL mode however the ZX81 allows continuously moving, flicker-free animated displays.

Printer
The 8K ROM will permit instructions (LPRINT, LLIST and COPY) to drive the Sinclair ZX Printer.

Programming
Programs can be entered via the keyboard or loaded from cassette. Programs and data can be saved onto cassette so that they

are not lost when the ZX81 is turned off.

Syntax check

The syntax of a line of program is checked on entry. A syntax error cursor marks the first place the syntax breaks down if there is an error. The syntax error cursor disappears when errors have been corrected. Only lines free from syntax errors will be entered into the program.

Graphics

Apart from the 20 graphics characters, space and its inverse, the display may also be divided into 64 x 44 pixels, each of which may be 'blacked' in or 'whited' out under program control.

Editing

A line editor allows you to edit any line of program or input, including program line numbers. Lines may be deleted, increased or decreased in size.

Arithmetic

Arithmetic operators +, –, x, ÷, exponentiate. Relational operators =, < >, >, <,< =,>=, may compare string and arithmetic variables to yeild 0 (False) or 1(True). Logical operators AND, OR, NOT yield boolean results.

Floating-point numbers

Numbers are stored in 5 bytes in floating-point binary form giving a range of $\pm 3 \times 10^{-39}$ to $\pm 7 \times 10^{38}$ accurate to 9½ decimal digits.

Scientific functions

Natural logs/antilogs; SIN, COS, TAN and their inverses;SQR; e^x.

Variables

Numerical:	any letter followed by alphanumerics
String:	A$ to Z$
FOR-NEXT loops:	A–Z (loops may be nested to any depth.
Numerical arrays:	A–Z
String arrays:	A$ to Z$

Arrays

Arrays may be multi-dimensional with subscripts starting at 1.

Expression evaluator

The full expression evaluator is called whenever an expression, constant or variable is encountered during program execution. This powerful feature allows use of expressions in place of constants and is especially useful in GOTO, GOSUB etc.

Command mode

The ZX81 will execute statements immediately, enabling it to perform like a calculator.

Cassette interface

Works using domestic cassette recorders. The transfer rate is 250 baud and uses a unique recording format not compatible with other systems. The ZX81 will save the data as well as the program to avoid the need to re-enter the data when the program is next loaded.,

ZX81 will search through a tape for the required program). The cassette leads supplied have 3.5 mm jack plugs.

Expansion port

At the rear, this has the full data, address and control buses from the Z80A CPU as well as OV, +5V, +9V, Ø and the memory select lines. These signals enable you to interface the ZX81 to the Sinclair 16K RAM pack and ZX printer.

Power supply

The ZX81 requires approximately 420mA at 7–11V DC. It has its own internal 5V regulator. The ready assembled ZX81 comes complete with a power supply. The ZX81 kit does not include a power supply.

TV standard

The ZX81 is designed to work with UHF TVs (channel 36) 625 lines.

ZX SPECTRUM

Dimensions

Width 233 mm
Depth 144 mm
Height 30 mm

CPU/Memory

Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.
16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard

40-key keyboard with upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes and 21 user-definable graphics characters. All keys have auto repeat.

Display

Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound

Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics

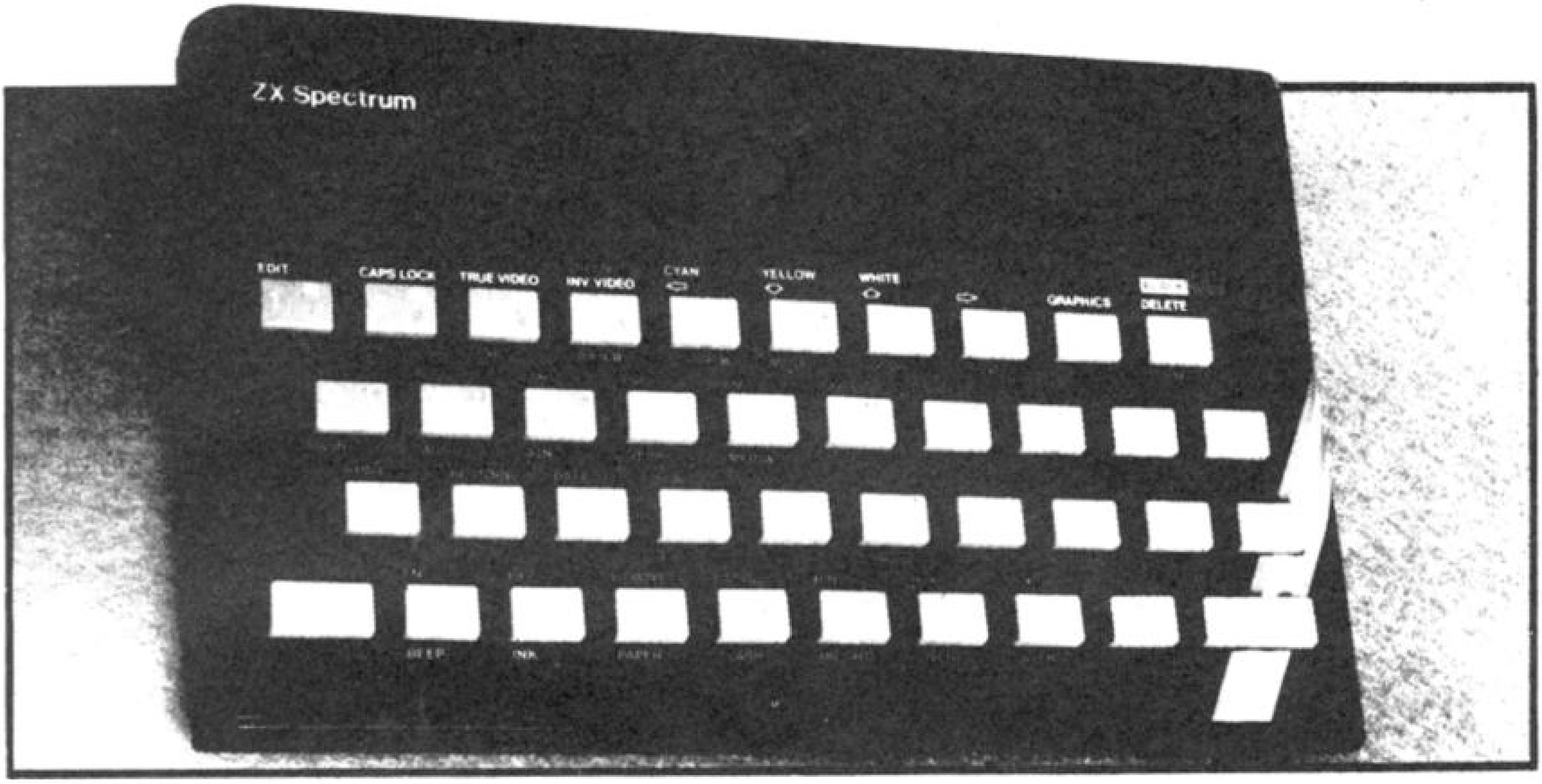
Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours

Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive – or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magneta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen

The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.



Mathematical Operations And Functions

Arithmetic operations of +, −, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generation, and pi.

Numbers are stored as five bytes of floating point binary — giving a range of $+3 \times 10^{-39}$ to $+7 \times 10^{38}$ accurate to 9½ decimal digits. Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).

User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.

There is a full DATA mechanism, using the commands READ, DATA and RESTORE.

A real-time clock is obtainable.

String Operations And Functions

Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code. A string slicing mechanism exists, using the form a$ (x TO y).

Variable Names

Numeric — any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).

String — A$ to Z$.

FOR-NEXT loops — A-Z.

Numeric arrays — A-Z.

String arrays — A$ to Z$.

Simple variables and arrays with the same name are allowed and distinguished between.

Arrays

Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression Evaluator

A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.

It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette Interface

A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.

All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.

Programs, blocks of memory and arrays may be verified after saving.

Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.

Programs may be saved with a line number, where execution will start immediately on loading.

The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion Port

This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives. IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 Compatibility

ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.

FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.

SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.

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fig. 1



fig. 2

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